AN INVESTIGATION INTO THE PRESENT TARIFF COST STRUCTURE AND A METHODOLOGY TO DETERMINE THE TARIFF INCREASE FOR ETHEKWINI ELECTRICITY

By

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Supervisor:

Prof. N.M. Ijumba

EXAMINER'S COPY

DECLARATION

I Ashwin Ramballee declare that:

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(ii) This thesis has not been submitted for any degree or examination at any other university.

(iii) This thesis does not contain other persons' data, pictures, graphs or other information, unless specifically acknowledged as being sourced from other persons.

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Prof. N.M. Ijumba

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I am sincerely thankful to my family and friends who have supported me throughout the years and from whom I have learned life's valuable lessons along the way. This dissertation is dedicated to my wife Sohana who's support and concern made it possible.

ABSTRACT

EThekwini Electricity (EE) purchases its energy on the Megaflex tariff from Eskom which has had considerable changes in content over the years. This has caused the present tariffs offered by EE to move away from cost reflectivity. Structural changes over the years have caused distortion to even the supposedly cost reflect 'Time of Use' tariff (TOU) which emulated Eskom's previous Large Power Users (LPU) tariffs. The divergence between the purchase of electricity and the method of recovery for the sales becomes a cause for concern. This opens EE to risk of not being able to offer cost reflective tariffs and diminish risks in recovery via the tariffs. This has an impact on the budgeted revenue.

The primary intention of this study was to establish a formalised procedure and to develop a methodology that Ethekwini Electricity (EE) can use for the review of their tariffs. This study was necessary and extremely crucial for the mitigation of financial risk when tariffs are reviewed and restructured since the revenue recovered via the tariffs are in excess of 5 billion rand per annum.

The study consisted of the development of a methodology which consists of a process flowchart and a series of Excel spreadsheets in which the analysis was done. The development of the model utilised information that were readily available and data that were extracted and manipulated from installed systems. The objectives were to determine all associated costs for the delivery of electricity, identify cost drivers, determine cost structure and finally determine applicable tariffs for EE. Issues such as customer categorisation, cross subsidisation, cost reflectivity and affordability were taken into account. This model could now be used in the future for tariff increases and applications to the regulator.

This methodology was used to design of the 2009/2010 electricity tariffs for Ethekwini Electricity. The outcome of this study resulted in the re-categorisation of EE's customer base, changes to the tariff structures and the phasing out of the non cost reflective tariffs. This study enabled the restructure of the LPU TOU tariff which was crucial for EE's cost recovery. It also resulted in the development of two new TOU tariffs for residential and commercial customers. Whilst other municipalities experienced difficulties in recovering their revenue due to Eskom's restructured Megaflex tariff, EE's actual revenue differed by 1% when it was compared to the budgeted revenue towards the end of 2009.

CONTENTS

LIST OF ABBREVIATIONS

AMR	Automated meter reading
CPIX	Consumer price index
CTOU	Commercial Time of Use
EDI	Electricity distribution industry
EE	Ethekwini Electricity
EXCO	Executive Committee
GDP	Gross domestic profit
ITOU	Industrial Time of Use
LPU	Large power user
MFMA	Municipal finance management act
MYPD	Multi-year price determination
NAC	Network access charge
NDC	Network demand charge
NERSA	National Energy Regulator of South Africa
NMD	Network maximum demand
NRS	National recommended standards
RED	Regional electricity distributor
RND	Reduced network diagram
RTOU	Residential Time of Use
SCADA	Supervisory control and data acquisition
SIC	Standard industry code
SPU	Small power user
TOU	Time of use
POD	Point of Delivery
COS	Cost of Supply

LIST OF TABLES

Table No **Caption** **Page**

LIST OF FIGURES

CHAPTER 1 INTRODUCTION

1.1 Background

EThekwini Electricity (EE) is an electricity distribution utility belonging to eThekwini Municipality, operating under the direction of the eThekwini Municipal Council. EE holds a temporary electricity distribution licence issued by the National Energy Regulator of South Africa (NERSA). This enables them to distribute electricity to consumers within the specified area as stipulated in their licence. In accordance with the Municipal Financial Management Act (MFMA), electricity tariff increases need to be effective as of 1 July each year in order to cover the budgeted expenditure over the subsequent financial year. These expenditures include capital expansions, operating and maintenance of the electricity networks and contributions towards other municipal services. According to the regulations set out by the NERSA, the increase can only be implemented once in that financial year. The duties of the NERSA include the approval of the budget by allowing only prudent costs and the promotion of efficiencies. The NERSA also does an analysis of tariffs category to ensure that the tariff charges are justified within that category.

Since these tariffs were designed some time ago and amended each successive year, it is necessary to conduct an investigation into the tariff structure in order to find out if these tariffs are still appropriate and if they still meet the needs that they were intended for. Therefore, an understanding of the cost drivers, cost structures and other issues such as cross-subsidization becomes very important when these tariffs are implemented and amended. Further to this, the development of a methodology for the implementation of tariff increases becomes important considering the financial impact, exit of experienced staff, the need for understanding and documenting processes and developing a cost reflective method of determining the increases.

1.2 Research problem

Currently, the revenue requirement is calculated by the Finance Department using the forecasted growth and budgets for the purchase cost of energy and other expenses which include contributions to the eThekwini City Council. Therefore, the budget need to be calculated correctly to ensure that

the costs are the true costs of providing the service and are the most efficient. The revenue requirements of the municipality in conjunction with guidelines from NERSA are used to determine the overall tariff increase. The load growth is estimated. However, there is an absence of a reliable method of determining the actual cost of supply for each tariff group and the cross subsidies that exist between them.

At present, the individual tariff increases are determined using guidelines from NERSA which provides recommendations for the overall and individual tariff increase, and benchmarks for the different tariff categories. At present the benchmarks are calculated for the 6 REDs (Regional Electricity Distributors) which were geographically determined. The operation of municipalities as a RED is not functional at present and the drive towards it has decelerated. The Municipalities that fall within these REDs need to conform to the respective benchmarks. Whilst this allows for the uniformity of tariffs within each RED, it moves away from cost reflectivity since the cost of supply differs in each municipality depending on factors such as customer locations which can be urban or rural, classification of large power user (LPU) and small power user (SPU) tariffs differing, as well as tariff structures being different. Another consideration is to have higher increases for obsolete tariffs and to endeavour to keep the indigent tariff low.

The results of this 'Top down' approach needs to be checked against the true costs of each tariff. Individual tariff volume and revenue from the 'bottom up' should be used to establish whether the revenue requirement has been appropriately determined.

EE purchases its energy on the Megaflex tariff from Eskom which has had considerable changes in content over the years. This has caused the present tariffs to move away from cost reflectivity. Structural changes over the years have caused distortion even to the supposedly cost reflective 'Time of Use' (TOU) tariff which emulated the Megaflex tariff in the past. This forms a significant gap in the current practice due to divergence between the purchase and sales aspects. It opens EE to risk of not being able to offer cost reflective tariffs to determine and recover the revenue that has been budgeted for.

1.3 Hypothesis

The review of electricity tariffs based on guideline increases from NERSA and revenue requirements of EE are not adequate. A methodology for the review and determination of electricity tariffs is required for effective cost reflectivity and cost recovery.

1.4 Objective of the research proposal

In an endeavour to address the identified shortfalls, an investigation into the true cost of providing the service and the associated electricity tariffs (i.e. Scales 1 to 12, Bulk and TOU) needs to be conducted and a methodology to calculate the effective tariff increase needs to be developed.

This research intends to provide an opportunity for EE to determine their cost drivers, its cost structure with its associated costs in order to arrive at cost reflective tariffs. The cross subsidies that exist between the different tariffs become an important part in the drive towards cost reflectivity.

This study adds further value to EE in that it will have a model that can be used henceforth and built upon for further tariff increases. The mitigation of financial risk when tariffs are reviewed and restructured makes this study extremely crucial due to the high revenue generated by the tariff.

On conclusion of this investigation, a possibility to conduct further investigations on other charges such as the connection and network charges laid out in the first schedule to the bylaws can be considered. The outcome of this investigation might provide information, which could suggest a need for further studies and may also contribute towards the progress of tariff alignment for the REDs.

1.5 Outline of subsequent chapters

Chapter 1 provides the introduction to the research content and the background of EE. The problem statement of the research will be outlined and the structure of the dissertation will be presented. This also includes the research objectives.

Chapter 2 provides a review of the key literature sources which deal broadly with theories and principles on the subject to establish the norms and practices. A comparison of tariffs at municipalities within South Africa and internationally is also discussed.

Chapter 3 will present the research methodology and Chapter 4 will deal with data analysis and the results of the study. Figures and tables will be extracted from the model in order to present and explain the results of the research.

The conclusion will be presented in Chapter 5 and in Chapter 6 the recommendations and suggestions for further research will be discussed. The research limitations will also be detailed in this chapter.

CHAPTER 2 LITERATURE SOURCES AND TARIFF COMPARISONS

Electricity tariff structure reviews are aimed at reviewing legacy structures with a view to presenting alternative tariff and charge structures which more adequately deliver benefits to all electricity consumers [1]. The pricing of electricity differs to the pricing of commodities due to its non-storability and transportation limitation [2]. In a regulated framework, electricity supply is considered a public service and usually vertically integrated, joining generation, transmission and distribution of electricity in government owned monopolistic companies [3]. The South African electricity industry is regulated by the NERSA. The responsibilities of the NERSA is to 'regulate prices and tariffs' and to 'enforce performance and compliance and take appropriate steps in the case of non-performance' [4]. In South Africa standards such as NRS 058 have been developed and based on the premise that all the data is available which is not the case for EE and other municipalities. EE has an asset register in which assets are stated at a department level. An asset management project which is being undertaken at present would assist EE with the separation of assets. This will allow the costs to be more correctly determined in the future.

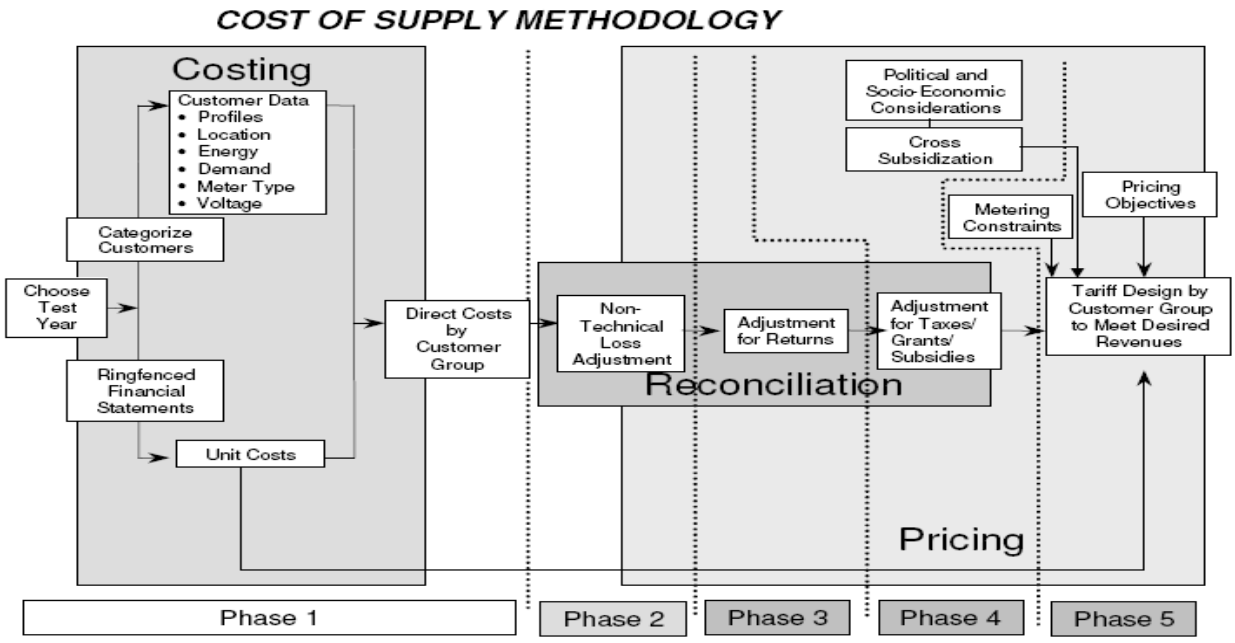
2.1 NRS 058

According to NRS 058, the Electricity Distribution Industry (EDI) needs to regulate the prices of electricity to different categories of customer [5]. In order for this to be done, a 'standard procedure of deriving and allocating costs, which is considered to be fair and equitable' needs to be accepted by all stakeholders [5]. The NRS 058 methodology presents the tariff design process in five different phases as illustrated in figure 2-1 and is described as follows:

- Phase 1: The allocation of all the direct costs of electricity supply, which is the main focus of the methodology where all the costs identified as direct costs associated with the supply of electricity are allocated to customer categories.
- Phase 2: In this phase, the pure costs are adjusted to account for any costs relating to non-technical losses including theft, bad debts and revenue protection.
- Phase 3: In this phase, the results of phase two are adjusted to include any returns that the utility is allowed to recover.

- Phase 4: This phase of the methodology includes any taxes, including contributions to municipal rates fund, or levies imposed in the electricity distribution industry in the allocated costs.
- Phase 5: In this phase the pricing policy of the utility is used to formulate prices from costs. [6]

Figure 2-1: NRS 058 Flowchart (source: NRS 058) [3]



The aim of NRS058 is to get utilities to understand how to do their cost allocation to their customer categories. The aim is to 'implement cost reflective tariffs, develop strategies to reduce costs, unbundle energy and network costs and developing norms and standards [3].

It goes on to state that electricity supply costs are dependent on the quantity of electricity, size of the supply, periods when electricity is used, supply voltage and the power factor.

Separation of costs is important when deriving tariffs. The costs should be expressed in a manner that will ultimately be applied to derive the tariffs according to an appropriate cost driver. The three relevant cost drivers mentioned are energy, demand and customer driven costs. The energy or unit cost consists of those costs that would vary with changes in the unit consumption of energy. It is

measured in c/kWh and is dependent on time. The demand-driven costs consist of those costs that would be induced in the business as the result of customers' demands on the electrical system. It is measured in rands per kilowatt hour and usually entails combined costs for infrastructure. The customer driven costs are costs that dependent on the number of consumers irrespective of how much electricity they use. It is a fixed cost measured in rand per customer.

It is also stated that all costs need to be recovered and that the utility needs to ensure that the tariffs recover the revenue that is required for the distribution of electricity. The NRS058 methodology was developed to provide the electricity distribution industry with a framework for determining the costs of supply. It forms a guideline that aids tariff design and it is not compulsory for the municipalities to utilise this methodology at present. There is a possibility that the NERSA could rule that the implementation of this methodology become mandatory [7].

2.2 DRAFT Regulatory Framework for Distribution and Retail

The regulatory framework was prepared by the NERSA to provide a view of the regulatory instruments required to regulate the regional electricity distributors (REDs) in support of restructuring the South African electricity industry. It was prepared with the intention of initiating and evolving regulatory policies and to take the electrical industry from 'the initial phase of restructuring, through the formation of the Regional Electricity Distributors (REDs) and ultimately the formation of independent REDs and the demise of the EDI Holdings Company' to the end-state position [8].

The framework offers a guideline for reorganizing the electrical distribution industry and is based to a large extent on the Blueprint Report. The intention is to ensure that electricity is reliable, the prices are kept low and that the quality of supply and service is good. The basic needs are to make the supply of electricity available to everyone without discrimination. The human resources strategy must be in line with social plans so that all stakeholders' interests are guarded and that the development of skills is considered. The future distributers must be self sufficient and operate at a optimum level whilst being operated as individual businesses. The industry must also ensure that there is job creation, job security and development of training and skills. Electricity must also be affordable and sustainable and follow the government's electrification decree [9].

2.3 Distribution Tariff Code

The purpose of the distribution tariff code is to provide guidelines for electricity pricing in the electricity distribution industry. NERSA regulates the prices that utilities charge for the distribution of electricity. The distributors charge the customers for this service by developing tariffs which have the different charges depending on criteria such as category of customers and size of customers. The distributor may also provide details or explain these tariffs and charges to the customers at times. This code for the distribution of electricity relates to all charges that are applicable for the distribution of electricity such as charges for infrastructure, connection to the network and customer services. In order to comply with the distribution tariff code, there are many objectives that need to be adhered to whilst meeting customer requirements. Cost effective recovery of the regulated revenue via the tariff and connection charges should ensure that acceptable levels of service are maintained.

Tariffs should be structured to ensure stability, efficiency and sustainability and be able to promote the overall demand and supply side economic efficiency. The cost of customers' current capacity and usage should be recovered. Specific tariff qualification criteria should be used to enable the tariffs to be non-discriminatory and transparent. Any cross-subsidisation should be done in accordance with government policy. An optimal range of tariffs should be designed in order to facilitate customer choices. These tariffs should be based on the consumers' usage patterns and be transparent and understandable. Connection charges should be charged for the provision of capacity as it is prescribed in the NRS069 document. The ring-fenced cost of retail and network services should be reflected where possible. When objectives conflict with each other, the objectives will need to be prioritized based on economic and social circumstances. [10]

The tariffs that are designed must take into account all cost drivers and send out implicit pricing signals. The separation of costs must be done. This broadly differentiates customers from each other in terms of customer's voltage, capacity and load profile. Costs that are not directly related to the supply of electricity must be separated from the supply costs. A distributor is allowed to recover costs that are related to compliance with NERSA. This is applicable for quality of supply and service to ensure that the minimum standards are met. Customers that require a higher quality of supply or service should pay for such services.

Stakeholder notification and participation is extremely important. The evaluation and approval of all new and changed tariff structures as well as non-standard negotiated tariffs shall be done by NERSA. The utility/service-providers need to consult with stakeholders when tariffs are proposed and approved. The methodology used for the determination of service tariffs for distribution retail and networks shall be justified and submitted to the NERSA. The Distributors/Service-providers should only charge tariffs that are approved by the NERSA and shall publish their approved schedule of standard tariffs. [11]

The three broad categories of costs are purchase, distribution and retail costs. Energy purchases from the generator or the transmission company form the purchase costs which are passed on to the customer. The cost of the infrastructure and its operation and maintenance becomes the distribution costs. Retail costs are the permissible costs which includes the profit or retail margin. Tariff structures should reflect cost drivers as far as possible. The tariff structures ultimately used are reliant on costs that are unbundled. All cost drivers must be taken into account when the tariffs are determined. Even though the prices are determined by the distributor, NERSA regulates and ultimately sets the prices of electricity that the customers will pay.

2.4 Comparison of EE tariffs

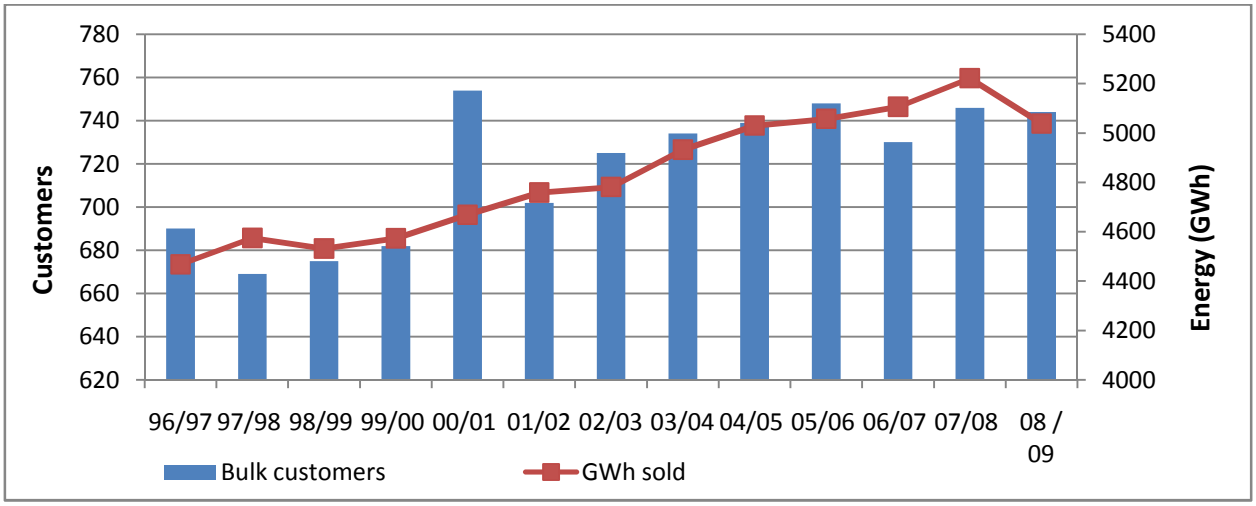
The objective of this study was to investigate the growth pattern of energy consumption and customer groups in eThekwini and highlight electricity price increases over the past three years. Growth patterns are useful for monitoring migration of customers between customer categories and tariffs and the increase in new customers and their loads. It is also used for the determination of the factor for the load growth when cost recovery calculations are done. The study also compared energy prices of eThekwini with other authorities around the world and those in South Africa.

2.4.1 Growth of Bulk customers

It was realized that the growth of the number of customers on the bulk tariffs had declined by 1% and that the energy consumption had decreased by 1.2% from the previous year. The reasons for this decline were to a small extent due to energy efficiency measures that were put into place and to

a larger extent due to an effect of the economic slowdown. Figure 2-2 below illustrates the growth of the bulk customers in eThekwini.

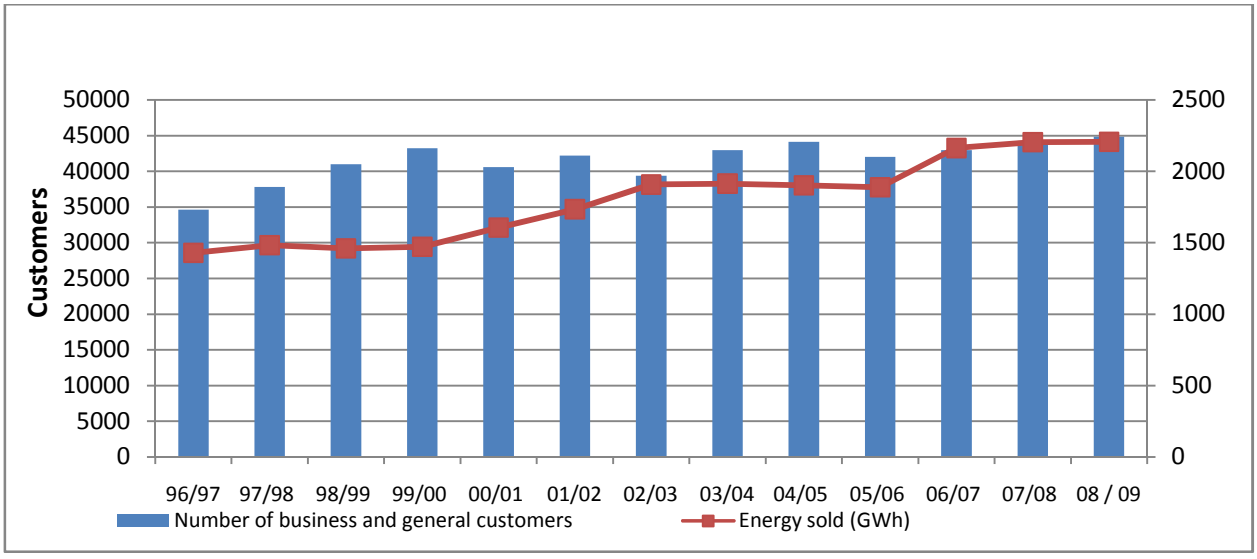
Figure 2-2: Growth of Bulk customers (2008/2009 Ethekwini Electricity Annual Report)



2.4.2 Growth of B&G customers

With reference to figure 2-3, it can be noted that the number of business and general customers have remained relatively constant and that the energy consumption has decreased by 0.5% from the previous year. Due to the economic slowdown, the business and general tariff is becoming a popular tariff which is due to customers reducing their consumption and demand.

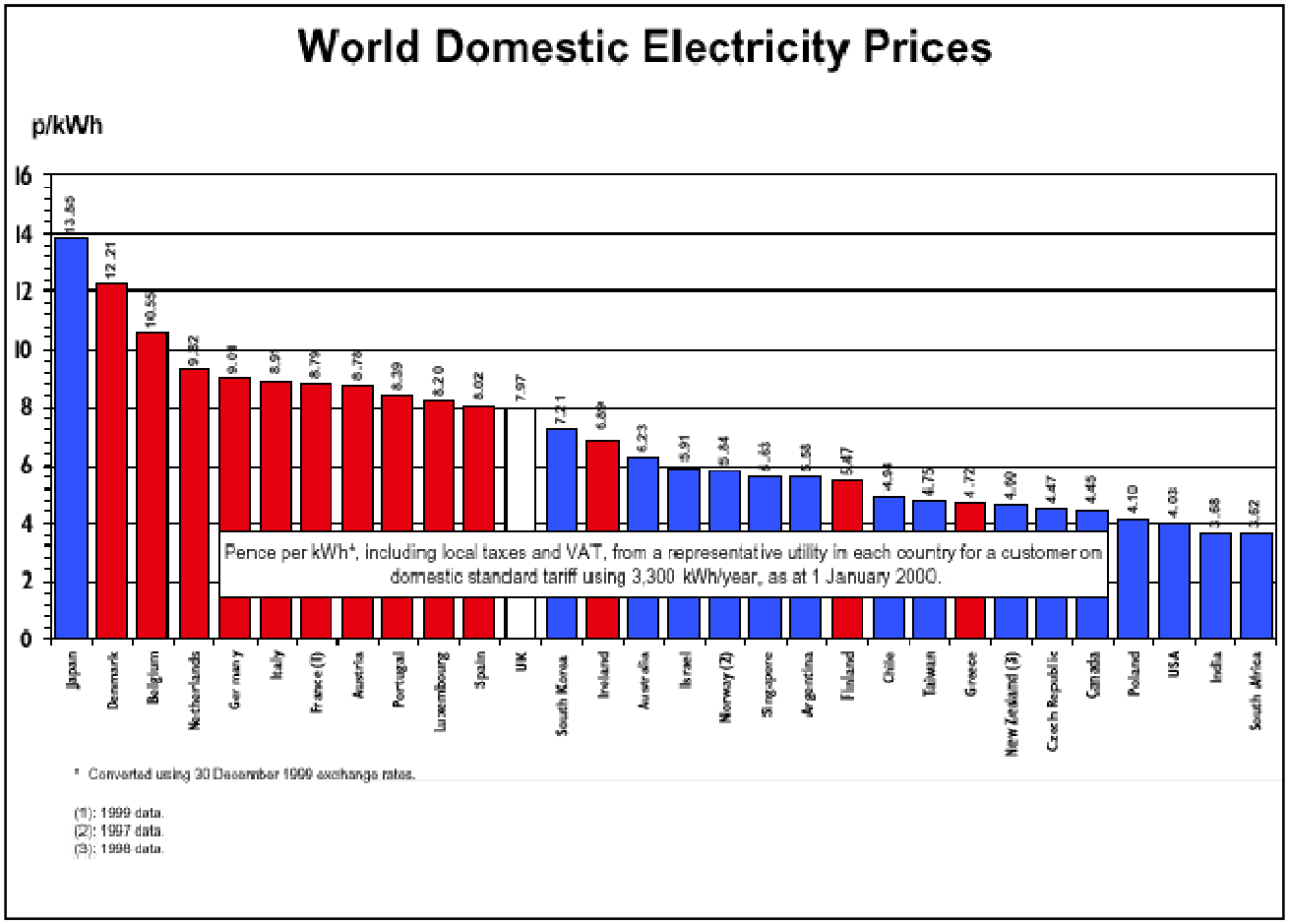
Figure 2-3: Growth of B & G customers (2008/2009 Ethekwini Electricity Annual Report)

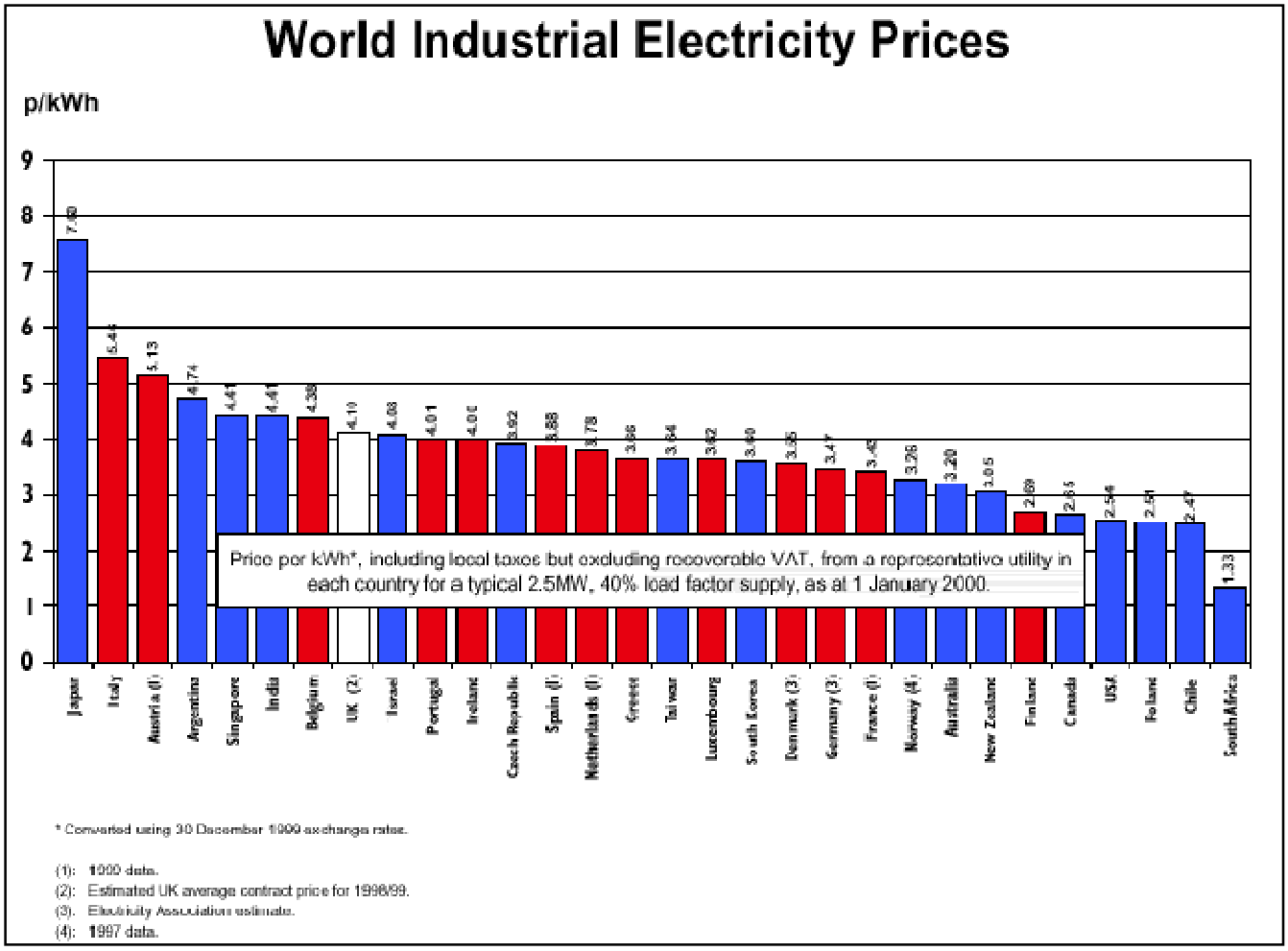


2.4.3 Energy trending – International prices

Electricity Tariff and tariff structures vary from country to country. It is dependent on many factors which may include government subsidies, generation fuel that is used and even weather patterns. For a long time electricity prices in South Africa was amongst the lowest in the world as seen in figure 2-4.

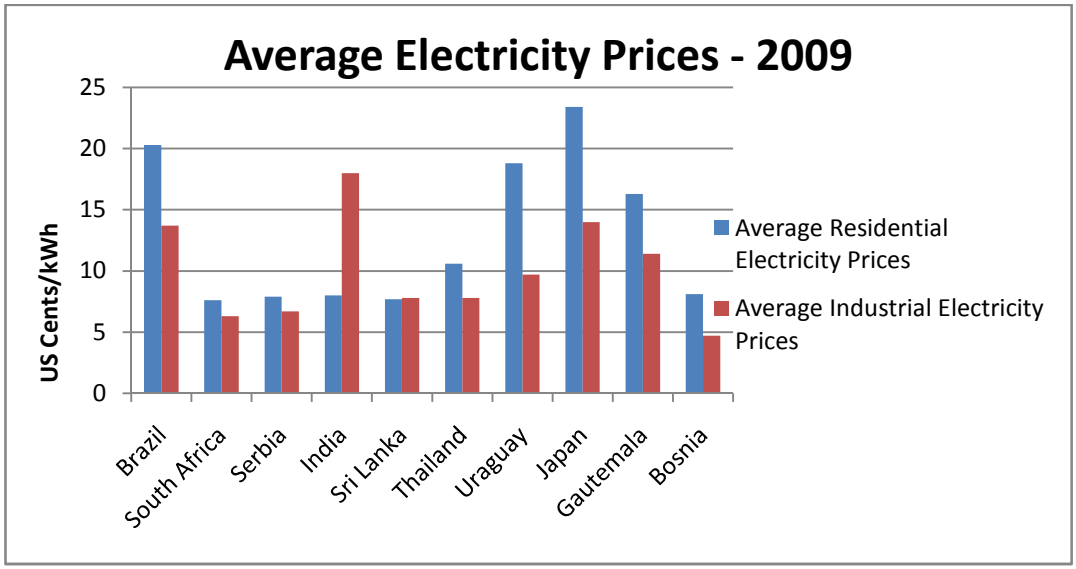
Figure 2-4: International electricity price comparison [www.solarbuzz.com/Solarpricesworld]





Energy trending was done to investigate the position of eThekwini Electricity's tariffs in relation to other international electricity supply authorities to highlight EE's position. The different countries have different prices based on their resources, GDP and other related factors. The countries chosen for the international comparison were selected due to their information being readily available. This comparison was completed at an energy workshop in Japan by members of these countries and EE. Figures 2-5 illustrate the comparison of international electricity prices for residential and industrial customers.

Figure 2-5: Average residential electricity price [12]



Electricity in several government states in India at provide subsidized rates for electricity or even free to some sections for agricultural use and for backward classes. This is done for compliance to India's Amended Electricity Act 2007 [13]. Measures such as these have caused many of the state electricity boards to become financially weak [14]. In 2009, the price per unit of electricity in India was about Rs. 4 (8 US cents) for domestic customers and about Rs. 9 for commercial supply [14].

A recent study shows that Ireland has the highest electricity price in Europe. This is due to about 88% of their electricity being generated from fossil fuels [15].

In Egypt, the electricity network was developed into a complex interconnected system which was referred to as the Unified Power System (UPS) [16]. Gas turbines and diesel generating plants were constructed in isolated areas that were not connected to the UPS. Their electricity prices have been subsidised and in 2007 it ranged between 1$ for residential to around 2$ for industrial customers for 100kW. Their tariffs are deemed to be non-cost reflective which has prompted the World Bank to call for Egypt to raise the price of electricity in line with international standards [17].

2.4.4 Energy trending – Local prices

Energy trending was done to investigate the position of eThekwini Electricity's tariffs in relation to other local supply authorities to highlight EE's position. The choice of the authorities for the comparison was based on them being the large municipal utilities in South Africa. The study was conducted to investigate the cost of eThekwini's new Industrial Time of use tariff compared to the other municipalities. The intention was to highlight whether EEs tariffs were in-line with other local tariffs or not. This was done acknowledging that each municipality differed in size, location, GDP contribution and structure. It was difficult to compare tariffs directly or on percentage increases as different utilities design their tariffs differently to ensure adequate cost recovery based on their specific overall load profile.

In order to compare EE's tariffs with others, customer consumption profiles were simulated and the different tariffs were applied. Differences in the total cost were used to judge the cheaper or more expensive supply authority for the profile of customers that were chosen. A simulation for time of use tariffs offered by EE and three separate supply authorities were done using four of eThekwini's largest loads. The figures 2-6 to 2-9 show a tariff comparison between the different utilities in South Africa.

Figure 2-6: Top customers >100MVA

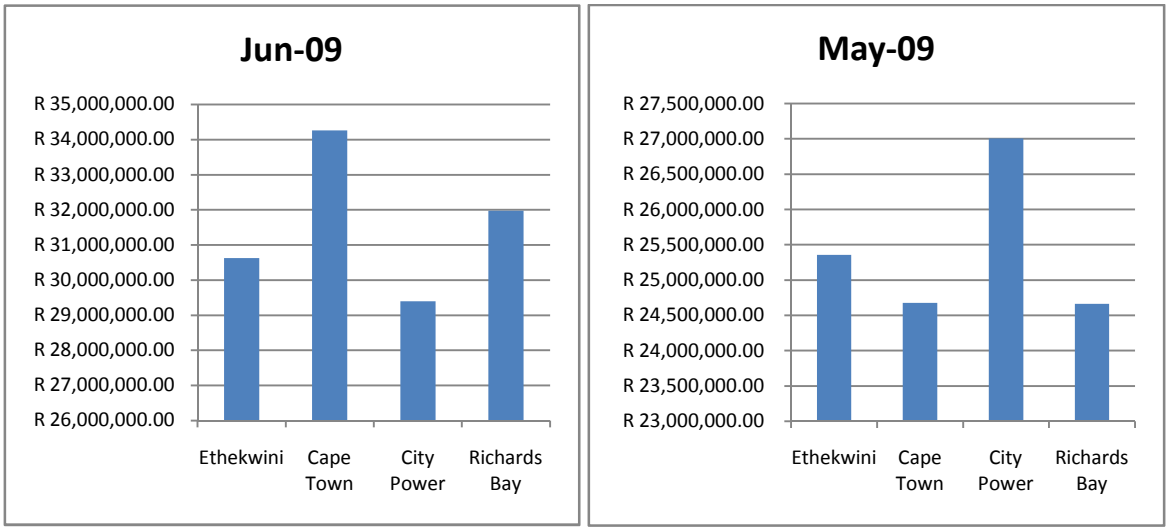


Figure 2-7: Top customers between 20-60 MVA

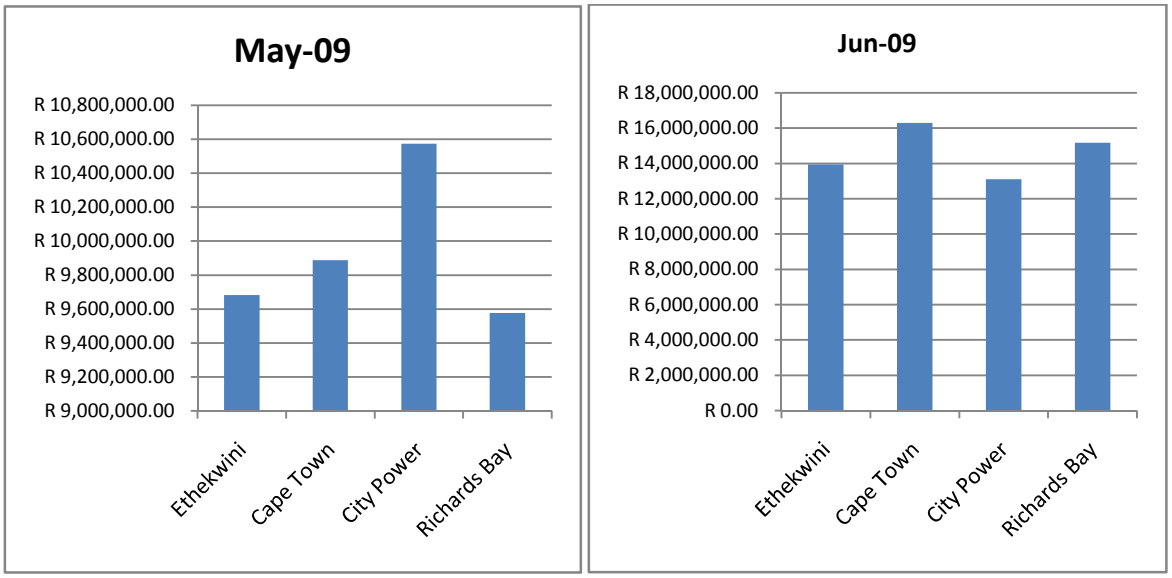


Figure 2-8: Top customers between 4-12 MVA

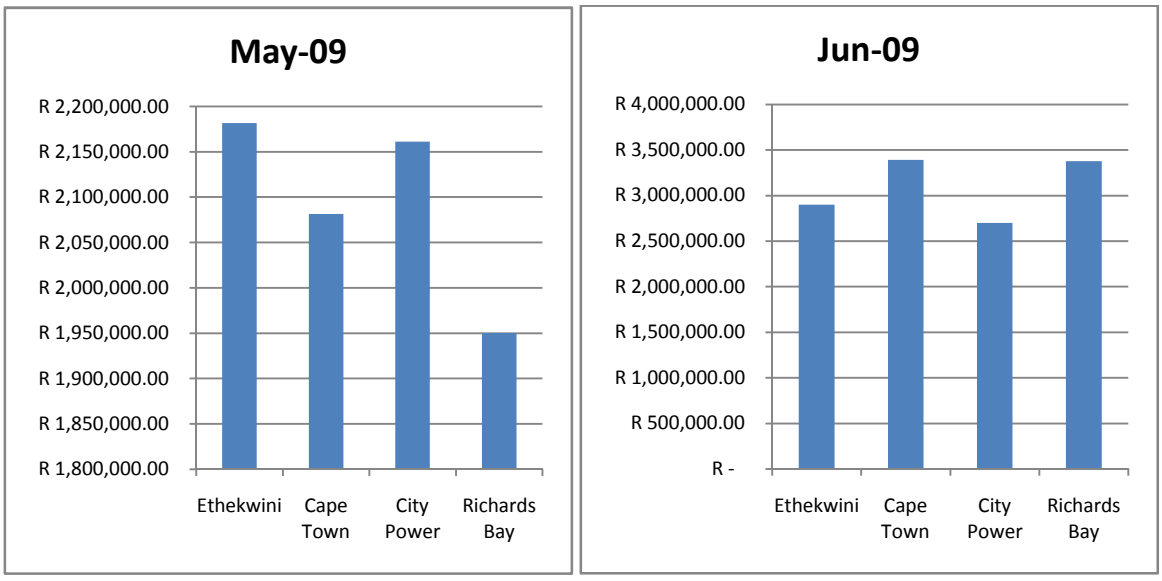
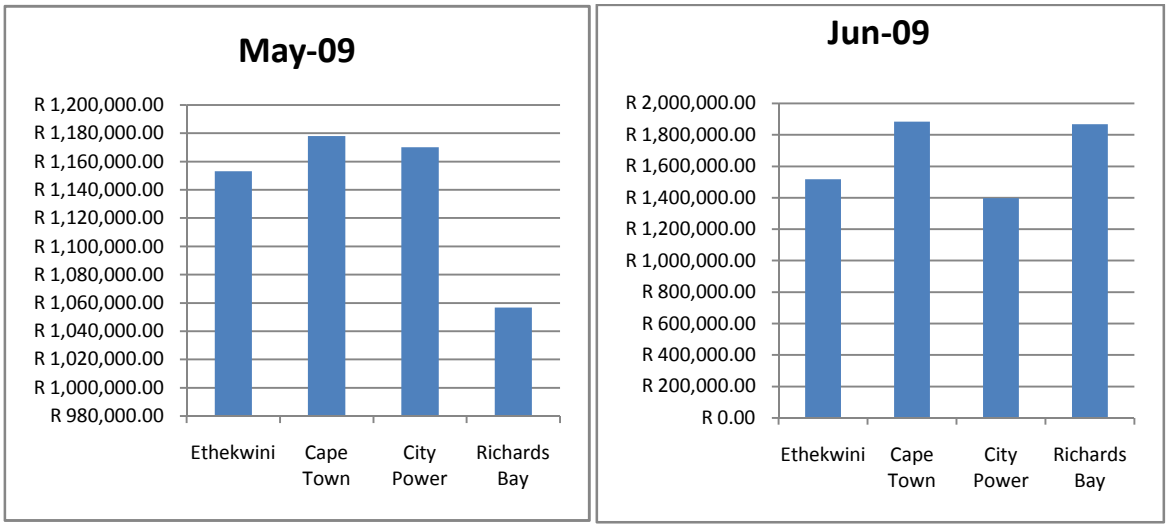


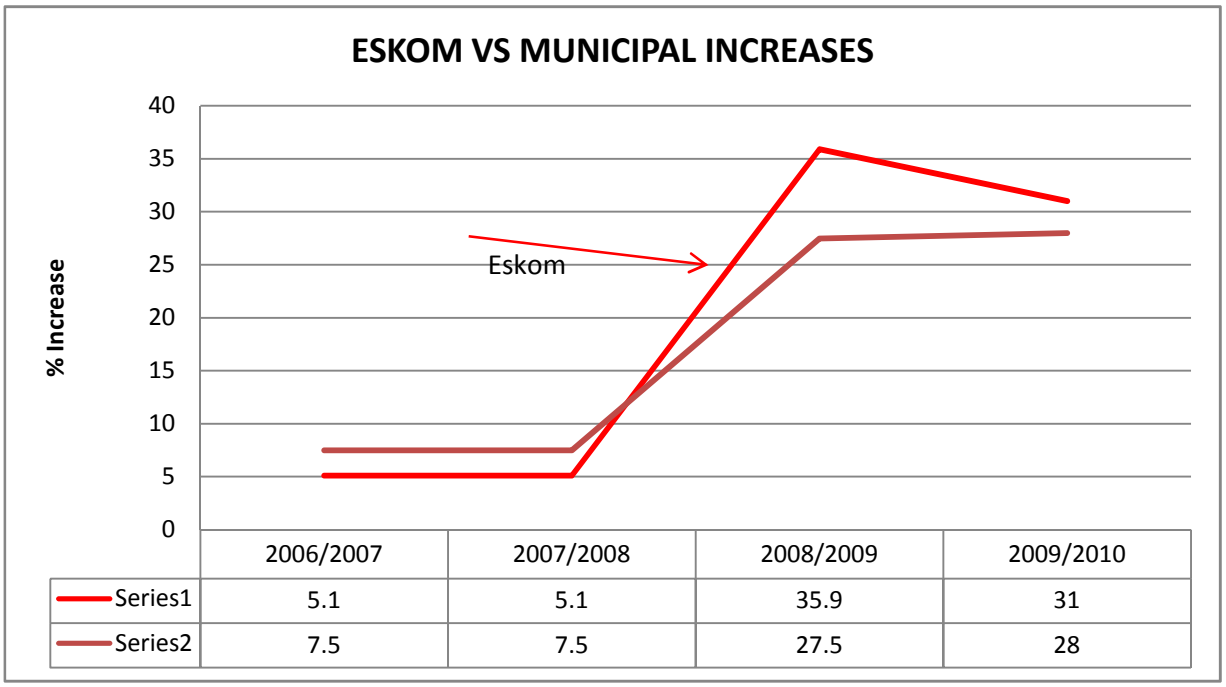
Figure 2-9: Top customers with 4 MVA



2.4.5 Electricity pricing in South Africa

The recent years have seen large increases in electricity tariffs. Since 2006 Eskom's tariffs were determined using the multi-year pricing determination (MYPD) [18]. This is a multi-year incentive-based method of adjusting prices introduced by the NERSA. The first MYPD was applicable from 1 April 2006 to 31 March 2009 with prices to rise by CPIX +1%. Eskom had completed the first year of the three-year MYPD then realized that additional capital expenditure (R97 billion to R150 billion) as well as significant increases in primary energy costs were needed. The MYPD restricted the rate of Eskom price rises until March 2009, Eskom not being able to recover costs and earn a fair return during this period, has now imposed massive price increase in 2010 (next MYPD cycle) to make up the under-recovery. To cushion the impact of a major price increase in 2010, Eskom proposed to spread this increase over two years, beginning with the last year of the current MYPD (2008/2009). Eskom made application on 30 April 2007 to NERSA to make changes to the rules for the MYPD. This was to cater for the pass through of primary energy costs incurred by Eskom, an allowance of compensation for increased capital expenditure and to review triggers for re-opening the price determination. The Eskom increases verses eThekwini's increases which was derived using the previous year's percentage increases is graphically illustrated in figure 2-10.

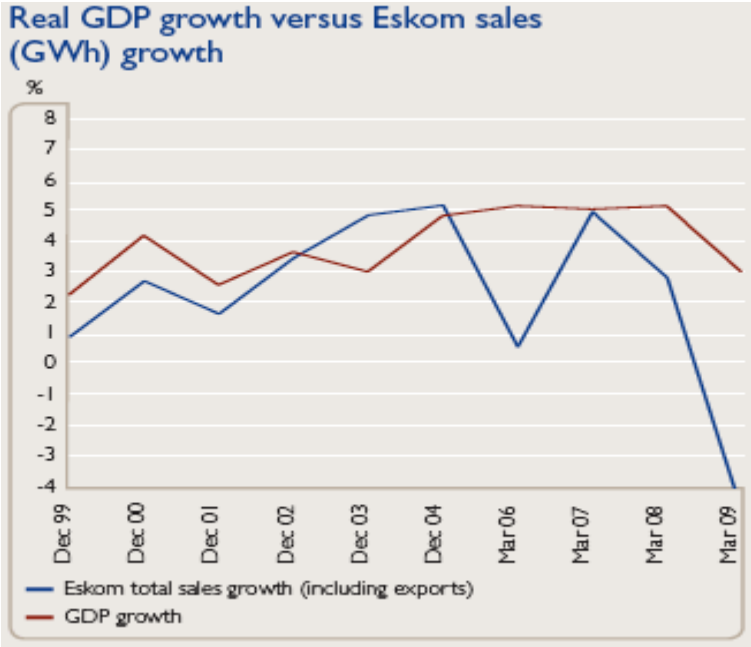
Figure 2-10: Eskom's price increase vs EE's price increase



South Africa and EE still remain among the cheaper electricity supplying authorities when compared internationally [19]. At a local level, customers with different load factors, voltages and demands benefit differently when applying tariffs from different supply authorities. However, it can be stated that eThekwini is among the cheaper electricity supply authorities in the country.

There has been a focus on electricity demand and pricing especially after the electricity crisis of 2008 where the shortage of demand led to months of load shedding in South Africa. According to a study done by Roula Inglesi the pricing of electricity can be used to influence the demand for electricity and encourage the saving of electricity [20]. It is stated that the demand for electricity will decline after the price re-structure that is being promoted by Eskom and the National Energy Regulator of South Africa (NERSA). The decrease in the population and the decreased economic growth will also curtail the electricity consumption. Figure 2-11 shows the growth in real Gross Domestic Product (GDP) versus the growth in the total sale of electricity for Eskom.

Figure 2-11: Growth in real Gross Domestic Product (GDP) [Source: 2009 Eskom Annual Report]



2.5 Advancement in technology

The use of technology has now made it possible to implement tariffs that are more cost reflective and allows for demand side management. Any change in tariff structures must take into account the changing technology that is required to support such changes [1]. Some of the technical problems that were experienced in the past have now been resolved due to the advancement in technology. Some of the technical problems that were previously experienced when a residential time of use pilot (RTOU) was done in EE related to clock drift on the meter and communication to those meters. Residential time of use tariffs could not be implemented successfully for these reasons at that time.

Most of these technical problems have now been resolved which now makes it possible to implement residential time of use tariffs and use additional features such as load management and control. The conclusions from pilot tests that were conducted by Eskom indicated that maximum load shift was achieved when the TOU tariff was combined with automated load management devices. It is the tariff that prevented the load management devices from being tampered with and kept it being operated normal. This allows the customer to realise financial benefits using this

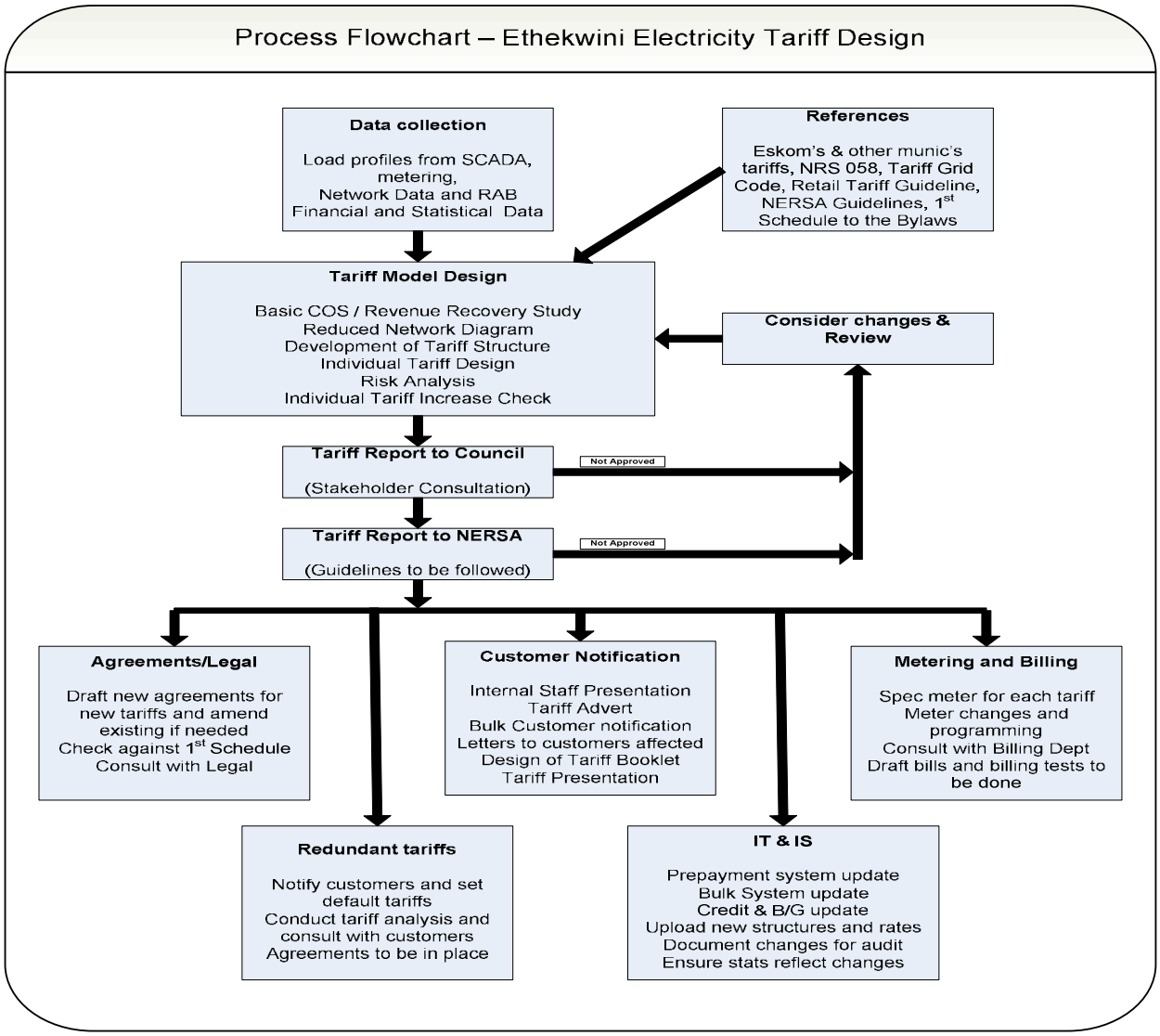
combination. The most cost effective solution for load management with metering technology is the implementation of smart metering. [21]

Even the costs associated with the electronic conventional meters that are used for residential metering have reduced in price and are equivalent to the mechanical conventional meters at present. If the cost trend continues, the electronic meters will become much cheaper in the years to come. Communication to these meters now allows for the implementation of tariffs that could not be offered previously. The added benefits include automated meter readings, tamper monitoring and remote disconnection and reconnections.

CHAPTER 3 RESEARCH METHODOLOGY

This chapter explores the methodology developed for the tariff design and review for the eThekwini Electricity department. It will concentrate on the construction of the model and its application using the data that is available and that has been extracted from the various systems used in EE (Ethekwini Electricity). It provides a technical guideline to determine tariff rates. The basic process flowchart seen below in Figure 3-1 was developed to highlight the modular breakdown of the tasks to be completed which formed the framework for EE's tariff design.

Figure 3-1: Process flowchart for electricity tariff design



3.1 Data collection

Large volumes of data are required for a thorough study to be done. Since not all data is available, assumptions and simulations need to done. In the case of metering, not all meters have the capability of storing load profiles and therefore data is extracted from the Supervisory Control and Data Acquisition System (SCADA) system. The data that is used in the case of EE is discussed as follows.

3.1.1 SCADA

Half hour consumption data is collected from all substations that have SCADA functionality. This data becomes useful for broad categories of customers such as determining the typical profile of low consumption residential customers. If we take a substation that is located in a low consumption residential area such as Sukuma, the data retrieved from individual feeders to the township provide a good load profile example. When the study was carried out, all substation feeders were listed and then separated into categories that were defined at the onset of this study. This was done with the assistance of the Network Operations control officers who know the system extremely well and were able to differentiate between customers that were fed off mini-substations, auto-reclosers and switch-pillars. SCADA data is requested on the ACS (Advance Control Systems) master station application named PRISM. This is a linux based system and in order for the data to be extracted, a macro is run using open-office and the information is saved on the redundant server so that the manipulation and extraction is not done on the 'live' servers A and B. Thereafter, a flash disk is mounted and the information is then copied using the 'rcp' command and saved as a xl5 file so that it can be opened on Excel.

3.1.2 Metering data

The Meter Engineering Branch is responsible for the metering of LPUs (Large Power Users). Industrial customers that are on the time of use tariffs have electronic meters that record consumption at half hour intervals and have automated meter reading (AMR) capabilities. Most of the other non-time of use meters do not have these features with the exception of few. It was unfortunate that there was not much previous load profile data collected from the bulk meters

which have the capacity of storing at least 6 month of previous history. Requests were done to the metering department to download the bulk meters that had half hour consumption history and for recorders to be installed to collect data from the others. There are approximately 700 industrial customers of which 200 customers were on a time of use tariff and the remainder was on other bulk tariffs. Samples were taken from accounts with top, middle and low consumption from each of the tariff groups. This gave an indication of the effectiveness of the tariffs for the different consumption levels.

3.1.3 Statistical data

Statistical data such as the number of customers, the growth rate, consumption figures, supply voltages and maximum demands were needed for each tariff type that was used in the model. Customer information, such as the number of customers, was requested using the function 'r,der000' whilst the consumption and revenue for each tariff type was requested monthly from the Elipse system for residential and commercial customers. When designing tariffs for bulk customers, individual customer information and the analysis of their monthly bills become vital. Since top customers' bills are as high as 20 million rand per month, the impact of tariff changes needs to be assessed in detail. This is where the bulk customer statistics files become important. There are two systems that handle customer statistics. One of them is the COINS system that handles the commercial and residential statistics whilst the other is the BEA system that handles the bulk customer statistics. The bulk customer information is requested on the BEA system using the path 'BEA CAP'. Once information such as the month and year is entered, the request is submitted by pressing the F9 key which sends the request to the Information Systems Department where the request is processed. Thereafter, usually the next day, the requested information is made available as files named 'BEA167.STAT' which contains the TOU tariff information and 'BEA190.STAT' which contains all non-TOU tariff information. Using a FTP (File Transfer Protocol) application, the files are downloaded onto a local drive and saved as a text file which is then opened in Excel.

3.1.4 Financial information

Financial information such as sales, income and expenditure and the annual budgets are requested from the management accountant of the Finance Department. It usually comes in a Quatro-Pro file

and needs to be reformatted to be used in the cost of supply financial spreadsheet. The capital accountant provides the asset information that becomes important when working out costs of supply. This information is requested in departmental form so that the capital costs are separated for each department. The financial information is crucial for the construction of the cost of supply financial statement and must be separated for each department (ie. Transmission Operations, MV/LV Operations, Technical Services, Customer Services, Administration and Human Resources). Financial reports that look at income from each tariff type including street lighting and public lighting are requested from the management accountant. It is important to ensure that grants and aids that are expense items are contra'd by being reflected as income so that the COS financial statements balances out.

3.1.5 Network data

In order for the reduced network diagram to be constructed, the supply voltage levels and point of delivery (POD) which is either from the busbars or fed via cables/lines, the grouping of customers according to their categories or tariff type, the transformation and the line losses are required. Network drawings for the different voltage levels (HV will be 33kV to 275kV and MV/LV will be 11kV and below) are requested from the Planning Branch. These drawings are used to construct the reduced network diagram (RND) and once the RND is completed, it is wise to consult with the planning engineers to check and amend it if required.

3.2 References

The principles that are applied when designing tariffs must comply with the most recent requirements from the NERSA, the eThekwini Bylaws, the retail tariff guideline, the tariff grid code and must take into account standards such as NRS058. These have been discussed in chapter 2 and are important considerations for the design of cost reflective tariffs that meet the current industry objectives.

3.3 Tariff Model

The complete tariff model consists of modular spreadsheets as it presents challenges if combined. These spreadsheets are discussed as follows:

3.3.1 Stats and tariff structure

The starting point for the tariff and structural review is to look at the current tariffs and determine whether they still meet the needs that they were intended for. The 'Stats&Tariff_Structure' spreadsheet contain the budget information and workings, TOU and other bulk stats, sales figures for each tariff type for previous years, summary of sales figures, prepayment statistics, number of customers and the summary of all this information. An analysis of the current tariffs and the comparisons between them are also completed. It goes through the current tariff structures, the changes that need to be explored with justifications and comments and eventually provide the proposed tariff structure which is fed into the revenue recovery model.

Table 3-1: Current tariff structure

			Fixed charge	Energy charge			Capacity charge	
Category	Tariff Name	Tariff Scale	Service Chg (R/Cust/Mth)	Energy Chg (c/kWh)	2 period T.O.U Energy Chg	3 period T.O.U Energy Chg	Demand Chg (R/kVA/Mth)	Action
Domestic	3 Phase Residential	3		X				change
Domestic	1 Phase Residential	4		X				change
Domestic	Small power users	8		X				obsolete
Domestic	Small power users	9		X				
Domestic	Free Basic Electricity	12		X				
Commercial	Business and General	1	X	X				
Commercial	Two Rate	2	X		X			change
Commercial	Business Cooking	5	X	X				obsolete
Commercial	Water heating and pumping	6	X	X				obsolete
Commercial	Water heating and pumping	7	X	X				obsolete
Commercial	Business and General	10		X				
Commercial	Business and General	11		X				obsolete
Bulk	LV 2 part		X	X			X	obsolete
Bulk	LV 3 part		X	X			X	change
Bulk	ST 3 part		X	X			X	obsolete
Bulk	TOU					X	X	change

Due to lack of consumption statistics in some cases, estimations need to be done by taking previous information and using splits and percentage growth. Estimations of this kind are noted and used as global variables. An example of the current tariff structure is shown in Table 3-1 which highlights the initial outcomes intended for the current tariffs.

All the information regarding the current and previous tariffs is consolidated in this spreadsheet as it will form the source of the information that is needed for the annual report and the 'D-Forms' that is required by the NERSA. Most of the reporting information that is required is derived from the basic information. An example of a previous year is illustrated below in Table 3-2.

Table 3-2: Statistics per tariff type

		Customers	Rands	kWh
Scale	Category	06/07	06/07	06/07
3	Domestic	8,215	R 30,210,599	83,323,017
4	Domestic	288,190	R 1,059,816,488	2,923,050,565
8	P/P	7,518	R 7,211,350	19,433,637
9	P/P	242,850	R 232,944,435	627,754,567
12	P/P	9,000	R 1,027,398	5,667,276
1	Commercial	37,528	R 604,306,675	1,643,557,706
2	Commercial	1,687	R 150,526,087	453,531,432
5	Commercial	1,022	R 18,484,497	49,008,702
6	Commercial	110	R 5,064,764	13,295,236
7	Commercial	11	R 506,476	1,329,524
10	Commercial	359	R 344,357	927,996
11	Commercial	135	R 129,494	348,968
0	Large:	11	R 8,377,557	33,080,203
0	Large:	505	R 282,124,963	1,114,018,194
0	Large:	1	R 47,538,463	187,713,671
0	TOU	213	R 893,193,917	3,770,791,179
0	Other	4	R 13,433,024	36,693,199
		597,359	**R 3,355,240,542**	**10,963,525,072**

3.3.2 COS revenue recovery

It is imperative to ensure that the revenue recovery is cost reflective and that there is mitigation of risks for reduced sales, input tariff changes and consumption pattern changes. The cost of supply and revenue recovery model serves this purpose. It becomes important when designing new tariffs to introduce new components such as service charges and also for the application of cross subsidies to occur. Using the electrical network diagrams which are obtained from the planning department, a reduced network diagram (RND) is constructed and the customers are pooled together and represented on it. Since the assets are ring-fenced according to the different departments, the asset

register is used to calculate the cost of the infrastructure used for supplying a particular category of customers. The more in-depth the separations of costs are, the more accurate the cost of supply becomes. Technical losses need to be reflected and accounted for on the diagram. This allows for a more accurate indication of the non-technical losses and for the units which are derived once the units that have been sold and purchased are reconciled. The budget for the review year is provided by the Finance Department and is used to complete the COS financial statement. The income is separated between the electricity sales and other charges such as connection charges and grants that have been transferred to capital. The expenditure needs to separated into network costs, support costs, electricity purchases and the contribution to rates. Shared costs can be split between the technical and the support costs using a percentage split. Once the costs have been separated, it can be allocated to the networks and the support expenditure. An example of these shared costs is seen in Table 3-3 below.

Table 3-3: Shared Costs

Shared Costs

Finance/Admin	R	930,796,450	
			% Split
Engineering	R	651,557,515	0.70
Support Costs	R	279,238,935	0.30
Human Resources	R	36,339,220	
			% Split
Engineering	R	24,347,277	0.67
Support Costs	R	11,991,943	0.33
Energy Related Costs	R	3,615,703,820	57%
Fixed Costs	R	2,711,027,650	43%

The information from the COS financial statement is then populated into the tariff structure model and it now becomes possible to cost reflectively recover the relevant support and network costs. Using the calculation of services charges as an example, the cost of making the service available and providing that service is calculated and recovery is subtracted from the support costs. There will be cases where service charges cannot be recovered as a tariff component in those cases it will be included in the energy charge as is the case in prepayment. The consequence of this is that if a consumer utilizes less energy, his contribution is less towards the supply costs and vice versa. A support cost weighting provides a means to estimate and determine the proportion between the different tariffs. The cost of services and infrastructure such as prepayment vending systems, meter reading and billing systems, customer interaction, service levels and marketing are used to determine the weights. This example is seen in Table 3-4.

Table 3-4: Support cost weighting

						service charges				
Category	Tariff Name	kWh	rands	rate	customers	support cost weight	Total Weight	cost per tariff using Support cost	Serv/Chg (2008/9) monthly	amount recovered from S/chg
Residential Low	Res TOU	83,323,017	51,478,475	0.62	8,215	3	24,645	155	20	R 1,971,600.00
Residential High	Home Use	2,923,050,565	1,805,913,792	0.62	288,190	1	288,190	52	20	R 69,165,600.00
Residential Low	Small power users									
Residential Low	Home P/P	647,188,204	428,323,220	0.66	250,368	1	250,368	52		R 0.00
Residential Low	FBET	5,667,276	15,255,818	2.69	9,000	1	9,000	52		R 0.00
Business Low	Commercial Low	1,707,191,168	1,100,944,033	0.64	38,671	3	116,013	155	129.81	R 60,238,590.12
Business High	Commercial TOU	453,531,432	261,453,613	0.58	1,687	3	5,061	155	129.81	R 2,627,873.64
Commercial	Business Cooking									
Commercial	Water heating and pumping									
Commercial	Water heating and pumping									
Business Low	Commercial P/P	1,276,964	845,123	0.66	494	1	494	52		R 0.00
Commercial	Business and General						0	0		
Bulk	LV 2 part									
Industrial	Blk TOU	1,114,018,194	599,577,848	0.54	517	10	5,170	518	505.81	R 3,138,045.24
Bulk	ST 3 part						0	0		
Industrial	New TOU	3,991,585,053	1,584,243,670	0.40	213	20	4,260	1,036	1011.62	R 2,585,700.72
Streetlighting	Citylight	36,693,199	24,512,907	0.67	4		0	0		R 0.00
Column Totals		**10,963,525,072**	**5,872,548,500**	**0.5356**	**597,359**	**43**	**703,201**			**139,727,410**

The next step is to use the profile data and separate the units into peak, standard and off-peak as seen in Table 3-5. In the case of the bulk TOU tariff, this information will be forecast using the previous year's actual information. This information is vital for determining the new time of use tariffs such as the CTOU tariff.

Table 3-5: Separation of units into peak, standard and off-peak

			High Season			Low Season		
Tariff Name	No of Cust	kWh	Peak kWh	Std kWh	O/Peak kWh	Peak kWh	Std kWh	O/Peak kWh
Res TOU	8,693	86,113,094	3,991,181	8,944,316	8,592,777	11,973,543	26,832,947	25,778,330
Home Use	304,956	3,020,929,087						
Home P/P	264,934	668,859,340						
FBET	9,524	5,857,045						
Commercial Low	40,921	1,764,356,566						
Commercial TOU	1,785	468,717,959	20,139,221	48,333,837	48,706,432	60,417,663	145,001,511	146,119,296
Commercial P/P	523	1,319,723						
LV 3 part	547	1,151,321,159						
New TOU	225	4,125,243,516	177,247,723	425,391,952	428,671,204	531,743,168	1,276,175,856	1,286,013,613
Citylight	4	37,921,873						
	632,112	**11,330,639,364**						

The rate table then calculates tariff rates by using the revenue recovery for the individual tariffs, subtracting the service charges and then calculating the rates. In the case of the new tariffs, the rates are calculated separately in spreadsheets that look at the design and risk analysis. Once this is completed, the rates are then used to calculate the revenue from the individual unit sales for each tariff. The revenue is consolidated at the end and checked back to the total revenue requirement to ensure that there is adequate recovery. The revenue recovery table as shown in Table 3-6, calculates the recovery for each of the tariffs and its components. This will help to identify the derivation of charges and costs correctly.

Table 3-6: Tariff rate table

	Fixed charge	Energy charge							Capacity charge	
Category	Service Chg (R/Cust/Mth)	Energy Chg (c/kWh)	High / S T.O.U Peak Chg	High / S T.O.U Std Chg	High / S T.O.U Off/P Chg	Low / S T.O.U Peak Chg	Low / S T.O.U Std Chg	Low / S T.O.U Off/P Chg	Demand Chg (R/kVA/Mth)	Network Access Chg
Residential Low	50	0.5372	83.577	42.6	31.98	83.58	42.6	31.98		
Residential High	20	0.5736								
Residential Low										
Residential Low		0.6404								
Residential Low		0.6404								
Business Low	129.81	0.5879								
Business High	103.85		124.51	49.1	36.73	51.04	40	34.76		
Commercial										
Commercial										
Commercial										
Business Low		0.6404								
Commercial										
Bulk										
Industrial	505.81		x	x	x	x	x	x	x	
Bulk										
Industrial	1011.62		85.45	24.76	14.82	27.29	18.09	13.71	36.78	11.39
Streetlighting		0.6464								

Once the COS financial statement and this model is complete, it becomes possible to insert new data such as the number of customers, their consumption, profile data and forecasted sales, and the spreadsheet will automatically calculate the new tariff rates and check that the revenue is fully recovered. This becomes useful when there are changes at the last moment allowing just individual information to be changed without redoing the study. Table 3-7 shows the final recovery table.

Table 3-7: Final recovery table

	Recovery	Service chg	Energy Chg							Demand Chg			
	Total Rands	Service charge	Single rate Energy Chg	High / S T.O.U Peak Chg	High / S T.O.U Std Chg	High / S T.O.U Off/P Chg	Low / S T.O.U Peak Chg	Low / S T.O.U Std Chg	Low / S T.O.U Off/P Chg	Demand Chg	Network Access Chg	Adjustments	Check
Res TOU	51,478,475	1,971,600		4,305,433	4,063,958	2,518,032	12,916,299	12,191,875	7,554,095			-42,384	0
Home Use	1,805,913,792	69,165,600	1,736,748,192										0
Small power users													
Home P/P	428,323,220		428,323,220										0
FBET	15,255,818		3,750,726									-11,505,092	0
Commercial Low	1,100,944,033	60,238,590	1,040,705,443										0
Commercial TOU	261,453,613	2,627,874											258,825,740
Business Cooking													
Water heating and pumping													
Water heating and pumping													
Commercial P/P	845,123		845,123										0
Business and General													
LV 2 part													
Blk TOU	599,577,848	3,138,045											596,439,803
ST 3 part													
New TOU	1,584,243,670	2,585,701											1,581,657,970
Citylight	24,512,907												24,512,907
	5,872,548,500	139,727,410	3,210,372,704	4,305,433	4,063,958	2,518,032	12,916,299	12,191,875	7,554,095	0	0	-11,547,475	2,478,898,695

3.3.3 Tariff design and risk analysis

When new tariffs are designed, the tariff structure and the consideration of the practical implementation become important. Factors such as availability and costs of meters, customer target market and barriers to customer migration to the new tariffs need to be examined and considered. This may require changes to the connection charges. This will also be the case when meters for these customers need to be changed. The designs of new tariffs require profile data so that the energy costs can be calculated. The energy cost is calculated using the Eskom Megaflex supply tariff once the peak, standard and off-peak energy and the demand is determined.

Since the supply of electricity forms approximately 60% of the total cost for the provision of electricity whilst the infrastructure and support costs are 40%, the tariffs will have to be designed to use this proportion with some adjustment to calculate variable and fixed costs. In the case of time of use tariffs, it is important to keep in mind that we cannot simply emulate the Eskom supply tariff because it represents a variable cost. Cost reflectivity does not mean that the designed tariff has to mirror the supply tariff in entirety which is a common misconception. The fixed costs are usually recovered as demand charges such as the NAC (network access charge) and service charges. The variable costs are the energy and demand charges.

A risk analysis must always be conducted using historic consumption and bills. Where there are no actual historic data, simulated consumption and bills are used. This is done by using the current

customer consumption to simulate bills on all the available tariffs and compare it to the current bills. It then becomes evident as to whether the new tariff is effective and whether it facilitates the migration of customers onto it. When attempting to move customers over from tariffs that are not cost reflective, the usual practice is to make them unavailable from that point and increase these tariffs, making them higher than the new tariffs, progressively over the forthcoming years.

As an example, the substation feeder data from the SCADA system was used to produce the profiles for the total residential low, high and residential mix customers in the residential time of use tariff design. The consumption for the residential customers was summated in half hour intervals allowing for the load factors to be calculated for the three profiles to be compared. The amended tariffs and new tariff structures and rates are developed so as to promote the objectives that were intended, whether it is energy efficiency, load shifting or customer migration into or out of these tariffs. In the 2009/2010 review, the following tariff design files were created.

- Residential-RTOU-Design_&_Risk-Analysis-Final - only time of use tariff that was available for bulk supply customers which was reviewed and changed structurally
- Industrial-ITOU-Design_&_Risk-Analysis-Final
- Commercial-CTOU-Design_&_Risk-Analysis-Final

3.3.4 Tariff increase calculation

Once the tariffs have been designed and the increases have been applied, it is important to check that the average increase equals the sum of all the individual increases. In this spreadsheet, the sales for each of the tariffs or category of customers are the previous financial year income containing actual amounts and some estimates for the months that remain in that financial year. These values are then increased by the growth in units that have been forecasted and their increases that will be applied to produce the revenue requirement. When the individual increase is the same as the average increase it is easy to calculate the revenue requirement, as the individual amounts are not needed. When the increases are not uniform, this spreadsheet serves the purpose of adjusting the revenue requirement from each of the tariffs so that there is no under recovery or over recovery. Table 3-8 that follows is a summary of the revenue recovery.

Table 3-8: Summary of Revenue Recovery

	08/09		Increase		09/10	
	Energy/Demand	S/C			Energy/Demand	S/C
TOU	1,288,689,262	0	28.40		1,671,223,783	
BULK	397,953,218		33.00		534,570,558	
B&G		0			0	
RES + Other	1,488,566,210	0	26.20		1,897,356,263	
PRE-PAY	330,391,340	0	26.20		421,123,410	
Ebsst	23,203,660	0	15.00		26,951,051	
Scale 001	854,660,620	0	28.00		1,104,905,250	
Scale 2	208,410,350	0	33.00		279,957,623	
					0	
					0	
	4,591,874,660				5,936,087,936	
				1.292737362		
Financial Requi	5,936,375,560					3,280,971,950
Difference	-287,624	-0.0048%				

The cell that contains the difference will indicate the difference between the financial requirement and the calculated revenue and need not be exactly zero but as close as possible.

3.3.5 Final Tariff Schedule 2009-2010

Once the tariffs and their increases have been finalized, the increases are inserted into the tariff increase table and are used to populate the worksheets that follow containing the new tariff schedule.

Table 3-9: Tariff Schedule

Residential / Business & General

	2008/2009 ENERGY CENTS/KWH	2008/2009 SERVICE CHARGE (R)		2009/2010 ENERGY CENTS/KWH	2009/2010 ENERGY INCL. VAT CENTS/KWH	2009/2010 SERVICE CHARGE (R)	2009/2010 SERVICE INCL.VAT RANDS
SCALE 1	52.2661	103.8475		66.9006	76.2667	116.3092	132.5925
SCALE 2 BASIC (Meter 021)	20.0112	103.8475	No longer	26.6150	30.3411	116.3092	132.5925
SCALE 2 S/CHARGE	47.5953	Nil	available fo	63.3017	72.1639		
SCALE 2 PEAK (Meter 0020)	67.6066	Nil	new	89.9168	102.5052	116.3092	132.5925
SCALE 2 OFF-PEAK	20.0112	Nil	customers	26.6150	30.3411		
SCALE 3	50.9480	Nil		64.2964	73.2979		Nil
SCALE 4	50.9480	Nil		64.2964	73.2979		Nil
SCALE 5 / 6 / 7	Obsolete Tariffs - Tariff structure as Scale 1						
SCALE 8	50.9480	Nil		64.2963	73.2978	Nil	Nil
SCALE 9	50.9480	Nil		64.2963	73.2978	Nil	Nil
SCALE 10	58.0204	Nil		74.2661	84.6634	Nil	Nil
SCALE 11	58.0228	Nil		74.2692	84.6669	Nil	Nil
SCALE 12	50.9480	Nil		58.5902	66.7928	Nil	Nil

This schedule is attached to the report to eThekwini's executive council (EXCO) and to the NERSA. This schedule must be checked exhaustively since it will be used as a reference document for the reports, for updating the billing system, customer notification and to produce the tariff booklet. An example of the residential and the business tariffs schedule is illustrated in Table 3-9.

Calculations of a draft bill for the new or amended tariffs needs to be done and this makes it easier to explain how the tariff is to be coded into the billing system. This example should allow the users to insert different readings (green cells in the example below) and calculate the bill accordingly as shown in the example of the ITOU tariff in Table 3-10.

Table 3-10: Bill calculations

Acc No: 10065599	XXXXX RETAILERS (PTY) LTD					
	Industrial Time Of Use					
	Units		Rate			Amount
(H/S) peak	40298.4		109.3729		R	44,075.53
(H/S) std	99167.4		31.6905		R	31,426.69
(H/S) off peak	94308		18.9719		R	17,891.99
(L/S) peak			34.93			
(L/S) std			23.16			
(L/S) off peak			17.55			
Network Demand Charge (R/kVA)	523.2		41.80		R	21,869.76
Network Access Charge (R/kVA)	575.52		12.54		R	7,217.02
Voltage Surcharge	400 Volts		22.50%		R	27,558.22
Service Charge			1713.63		R	1,713.63
Total					R	151,752.85

3.4 Tariff reports

The tariff reports to the EXCO and the NERSA are similar in many respects. The introduction should highlight the average increase and the factors that influenced it. These reasons could be:-

- Increased revenue requirements arising from capital and operating expenditure as well as CPIX.
- Continuation with the rationalisation of tariff structures.
- A move towards compliance with national guidelines.
- Increases imposed from ESKOM.

Thereafter, there should be a discussion which looks at the technical, social and other considerations used to motivate and justify the changes and increases to the existing individual tariffs, new tariffs and redundant tariffs. Using the 2009/2010 tariff as an example, these key factors could be:

- Restructuring of the TOU tariff in line with Eskom's input tariffs in order for it to become more cost reflective.
- The introduction of a non-seasonal residential Time-of-Use tariff that will be available to residential customers consuming more than 1000kWh per month as soon as the Smart Metering Project is implemented.
- The introduction of a commercial Time-of-Use tariff which will be seasonally differentiated and will have a service charge and no maximum demand charge for consumption below 100kVA.
- Higher increases for tariffs that are discontinued which is essential to facilitate the migration of current customers off these tariffs.
- Customers that have been on redundant tariffs over the previous years will be transferred across to the available tariffs. The affected customers are consulted with to ensure smooth transitions.

Thereafter a summary of the tariffs, their increases and a brief description and motivation for the respective increases are tabled.

Finally, the report to the EXCO committee will contain a recommendation for the tariffs set out in the tariff schedule to be levied in respect of the supply of electricity and for it to be submitted to the NERSA for approval. The report will also contain the vote numbers for the provision of the budgeted revenue that will be provided by the finance department.

The report to the NERSA should furnish the copy of the approved council resolution for the proposed tariffs if it is approved by EXCO before the application to NERSA. In addition, it must be accompanied with the NER D7 form which is the official application for a tariff increase and the schedule of charges. Stakeholder participation in the form of public meetings, tariff increase advertisements and letters to customers must form part of the process.

3.5 Implementation of tariff increases

Once the tariffs are approved there is usually not much time left for the implementation of the tariff increases. Numerous tasks need to be tracked and completed to ensure that no problems arise thereafter. These tasks can be broken up into the following sections.

3.5.1 Agreements and Legal consultation

All the agreements that need to be changed due to changes in their structure, components of the tariff or the rules that govern them, need to be checked by the legal department to ensure that it complies with legislature and is legal and binding. The cross reference between the electricity bylaws, and both the schedules thereof should be checked and be in sync. The agreements should be drafted and sent to legal for perusal before meeting with the legal representative to examine it and have it finalized.

3.5.2 Stakeholder notification

It is important to notify all stakeholders about the tariff review and not only concentrate on the end customers. It is best to start off by presenting the proposed tariffs and structural changes to the internal staff that handle related matters. This will include the customer services, metering, billing, information systems, contact centre and the planning branches. Valuable input regarding the effectiveness, new considerations and potential problems that may arise would come from this group. The municipality is obliged to give all customers notification of at least a month prior to the increase being effective. Using the tariff schedule, a draft advert is compiled and sent to the promotions designer who arranges to have it prepared and ready for advertising. This tariff advert is usually placed in the major newspapers notifying the customers of the proposed increases. An example of such an advert is shown in appendix C. There will be a note that the tariffs are subject to the approval by the NERSA, if the tariffs are not approved by the regulator at that stage. Bulk customers are notified by letters which are sent out with their monthly bills or posted separately.
The tariff booklet is drafted and sent to the promotions designer who formats it and arranges to have it printed and ready for distribution. A tariff presentation is delivered to the top customers and this is one of the major events of the electricity department. An agenda is put together with related

subjects and current topics as shown in appendix D, which is the agenda of the 2009/2010 tariff presentation.

3.5.3 Redundant tariffs

Letters are also sent out to customers that have considerable changes to their tariffs or are being moved off their tariff. These changes are explained. A tariff analysis is usually done for these affected customers and these customers may be contacted and consulted with depending on the circumstances. Tariffs become redundant after being phased out for a few years by imposing higher than average increases, therefore customers are usually moved over to cheaper tariffs. This was the case with business customers that were moved off the scale 5, 6 , and 7 business tariffs onto the scale 1 business tariff. Another factor that promotes the movement of customers off redundant tariffs is changes to measurement periods. In the case of the LV3-Part tariff, this can be done by increasing the duration for the restricted demand period. As much as it may inconvenience customers, cost reflectivity and the current pricing signals are important and therefore tariffs that do not serve the current purpose need to be made redundant if not amended.

3.5.4 IT and IS

Since the prepayment system is separated from the credit meter billing system, the prepayment tariffs need to be sent to the person in charge of the prepayment vending system so that the new rates can be loaded onto it. The credit meter rates are loaded onto the ‘bea’ system in the case of bulk tariffs and the ‘coins’ system in the case of the residential and business tariffs. When these rates are loaded, screen dumps are taken of the current rates and all the screens that are used. An example is the ‘mtr’ (maintain tariff rates) screen. Thereafter, the new rates are loaded on and screen dumps are taken once again reflecting the new rates and configuration data. The screen dumps represents a picture of the before and after and becomes useful if a problem with the new rates emerge. Apart from this, it is used for audit purposes by sending it to the internal auditors ensuring that the capture is correct. It is also important to note that there could be an impact on the statistics files and reports when tariffs and their structures are changed, new tariffs are added on and when tariffs are made redundant. Therefore stats that relate to tariffs, number of customers,

consumption and tariff revenue need to be checked to make sure that the necessary amendments are done.

3.5.5 Metering and Billing

Metering plays an integral part of the tariff design and its implementation. Usually the tariffs are based on the capability of the meter. For example, a time of use tariff for a category of customers can only be made available if there are meters available for them to measure the consumption during the different time intervals. The meter specification and costs will differ for each category of customers. In EE, the cost of the meter and the installation of it is recovered via the connection charge and not via the tariff. When a new or different type of meter is required for a tariff, it will mean that the connection charges will need to be amended or new items or costs inserted. The metering requirements for new tariffs must be identified early and the meter engineering branch must be consulted with to ensure that these requirements can be met. It is extremely important to ensure that all meters that need to be reprogrammed are done in advance and that sufficient time is allowed for this to be done. Draft bills are sent to the billing department. It is important to explain new tariffs and the changes to the more complicated tariffs to the billing clerks that use them. After the tariffs have been loaded onto the system, test billing runs should be done in a test environment of the billing system to ensure that the bill calculations are all correct.

For current and future use, a revised cost of supply study is important in maintaining cost reflectivity via the tariffs. this is due to changes to consumer consumption patterns, network changes and structural changes to input tariffs that are proposed or have occurred previously.

CHAPTER 4 ANALYSIS AND RESULTS

This chapter looks at the tariff design using the methodology and the models that were developed. This methodology was used in the 2009/2010 tariff review which facilitated structural changes and new time of use tariffs for eThekwini Electricity. The current pricing signals played an important role in the tariff design. Due to the electricity capacity shortage and the possibility of load shedding in peak periods, the focus was on sending out signals that promoted energy efficiency and the reduction in the peak demand. This chapter will take us from the categorization of customers to the final approved tariffs and its structures for the 2009/2010 year.

4.1 Customer categorization

Initially customers in EE were categorized according to their SIC codes. However, over the years this has fallen away since this information was not consistently captured on application. Due to insufficient information on group customers according to their economic activities, categorization was done using the meter type that facilitates the structure of the tariff as reflected in Table 4-1 below.

Table 4-1: Current customer categorization

Category	**Meter type**	**Typical consumption**
Residential Low	Prepaid meters	Wide range
Residential High	Credit meter	Wide range
Business	Single and two register meter	< 100 kVA
Industrial Low	Energy and demand meters	From 100 kVA to 500 kVA
Industrial High	Time of use and demand metering	> than 500 kVA

The differentiation between residential high and residential low customers using meter types as seen above was not an accurate method as there were high consumption users using prepaid meters and there are also very low consumption users using credit meters. This situation worsened as the installation of prepaid meters and credit meters was decided upon by the customer. On the other end we have the industrial high and industrial low consumption customers which was differentiated

based on their meter type and tariff that they were on. The electronic meters which offered time of use measurement and had automated meter reading (AMR) capabilities were initially expensive. It was only used for the TOU tariff customers. Due to the advancement in technology and the decrease in costs, these electronic meters were rolled out to the other bulk customers.

The considerations taken into account when the categorization was done suited the needs at that time; however there is always a need for revision. Tariff harmonization towards the REDs or the changes to policy and legislation such as the rollout of smart metering has an influence on the way customer categorization is done. When the new categorization was done, there were no clear guidelines available from the NERSA or EDI Holdings for tariff categorization therefore it had to be done according to EE's requirements.

According to recent legislation, utilities are obligated to install smart meters for all customers consuming above 1000 kWh. This becomes a catalyst towards the creation of a smart-grid and also required us to categorize our customers more effectively. By installing these meters in the high consumption areas and allowing other high consumption customers to utilize these meters, we can now more accurately define the residential high category.

EE currently have approximately 180 industrial high customers that are on a time of use tariff and 750 industrial low customers that are on energy and demand tariffs. Since all meters are electronic, it became possible to have all the industrial customers on a time of use tariff by re-programming these meters and amending the billing program. This change coupled with the reduction of the qualifying criteria from 500 kVA to 100 kVA for the existing TOU tariff allowed for these two categories to be combined.

Table 4-2: Re-categorization of customers

Category	**Meter type**	**Typical consumption**
Residential Low	Prepaid meters/conventional credit/smart meters (Mechanical/Electronic meters)	< than 1000 kWh
Residential High	Smart meters (Electronic)	=> than 1000 kWh
Business Low	Multi-register meters (Mechanical/electronic)	less than 100 kVA
Business High	Time of use metering (Electronic)	less than 100 kVA
Industrial	Time of use and demand metering (Electronic)	> than 100 kVA

The commercial sector which has about 45000 customers needed to be split into high and low categories. The commercial high category accommodates the low consumption industrial customers that do not qualify for the re-categorized industrial tariffs and indicate the higher consumption business customers. We were now able to split the 45000 customers into two groups. The groupings of these customers were influenced by the Scale 1 and 2-rate business tariffs which were the available business tariffs. The re-categorized structure is shown in Table 4-2.

4.2 Tariff structures

The existing tariff structure for EE contained different tariffs within the same categories that had the same rate. Some tariffs had higher increases in the past to encourage customers to move off them. The obsolete tariffs had exhausted their lifespan as they were no longer cost reflective. It was the opportune time to move these customers over to other available tariffs. This process required consultation with the affected customers prior to its implementation.

Table 4-3: Proposed changes to the structure

				Fixed charge	Energy charge		Capacity charge	
Category	Tariff Name	Meter Type	Tariff Scale	Service Chg (R/Cust/Mth)	Energy Chg (c/kWh)	3 period T.O.U Energy Chg	Demand Chg (R/kVA/Mth)	Network Access Chg
Residential Low	Res TOU		3	X		X		
Residential High	Home Use		4	X	X			
Residential Low	Small power users		8					
Residential Low	Home P/P		9		X			
Residential Low	FBET		12		X			
Business Low	Commercial Low		1	X	X			
Business High	Commercial TOU		2	X		X		
Commercial	Business Cooking		5					
Commercial	Water heating and pumping		6					
Commercial	Water heating and pumping		7					
Business Low	Commercial P/P		10		X			
Commercial	Business and General		11					
Bulk	LV 2 part							
Industrial	Blk TOU			X		X	X	X
Bulk	ST 3 part							
Industrial	New TOU			X		X	X	X
Traction	Transflex			X		X	X	X
Streetlighting	Citylight				X			

Key	Tariff state
	Obsolete
	Unchanged
	New
	currently being investigated

A study into the impact of the tariff migration had to be done in these cases. Table 4-3 illustrates the changes to the tariff structures that were investigated and considered as part of the study. Table 4-4 contains the reasons that were provided for these changes.

Table 4-4: Explanation of proposed changes and deletions

Category	Tariff Name	Tariff Scale	Explaination
Residential Low	Res TOU	3	Being a 3 phase residential tariff, most/all of these customers would have high consumption. With the installation of smart meters, it becomes possible to administer a residential time of use tariff. A service charge will also be included for this tariff
Residential High	Home Use	4	This tariff will remain the same with the only change being the inclusion of the service charge. A Block Incline mechanism would have aided the high consumption users to move over to the residential time of use but it is still premature to have this done. This can be implemented at the next review if there are no problems experienced.
Residential Low	Small power users	8	Scale 8 and scale 9 have the same rate . If there are no good reasons for keeping scale 8 & 9 separate, scale 8 will now be combined with scale 9 and if the customers are transferred over, then it will be made redundent.
Residential Low	Home P/P	9	This tariff will maintain it's customers and designation since the majority of prepaid customers are on it.
Residential Low	FBET	12	The free basic electricity tariff (FBET) will continue to be administrated as it has in the past.
Business Low	Commercial Low	1	This tariff will remain unchanged and a step tariff could be considered to facitate customer migration to the commercial time of use tariff.
Business High	Commercial TOU	2	This tariff being a 2-rate tariff have electronic meters and can be investigated for the adoption of a time of use energy charge.
Commercial	Business Cooking	5	This tariff has been identified as being phased out and obsolete over the past few years over which most of the customers have moved off. The remaining customers in these tariffs will have to be consulted with and then moved over to either the normal business tariff or the time of use one.
Commercial	Water heating and pumping	6	This tariff has been identified as being phased out and obsolete over the past few years over which most of the customers have moved off. The remaining customers in these tariffs will have to be consulted with and then moved over to either the normal business tariff or the time of use one.
Commercial	Water heating and pumping	7	This tariff has been identified as being phased out and obsolete over the past few years over which most of the customers have moved off. The remaining customers in these tariffs will have to be consulted with and then moved over to either the normal business tariff or the time of use one.
Commercial	Commercial P/P	10	This tariff will remain unchanged.
Commercial	Business and General	11	Scale 10 and scale 11 have the same rate . If there are no good reasons for keeping them separate, scale 11 will now be combined with scale 10 and if the customers are transferred over, then it will be made redundent.
Bulk	LV 2 part		This is one of the obsolete tariffs. The remaining customers will have to be moved over to the LV3 part tariff or a new bulk time of use tariff if implemented.
Bulk	Blk TOU		The LV3Part tariff would be changed to a time of use tariff to cater for the mini-bulk or will stay the same and a new mini-bulk tariff will be introduced.
Bulk	ST 3 part		There is only one customer on this tariff which is Stanger and Rosburgh traction. The customer need to be informed about the redundency of this tariff. Upon consultation with them, they would either have to go onto a diversified maximum demand time of use tariff or have a new traction tariff designed for their use.
Bulk	New TOU		Due to the various structural changes, it is time to have this tariff emulate the Megaflex tariff on which EE buys their bulk supply on, so that can become more cost reflective.
Traction	Transflex		If the ST3Part tariff is redundant, this tariff will have to emulate Eskom's Transflex tariff if the traction customers are not moved over to available time of use tariffs
Streetlighting	Citylight		more important as we move towards REDs where transactions are not just paper exercises.

The tariff structures were finalised and presented to the executive committee for comment and approval. These structural changes involved changes to rules that apply such as rules for Notified Maximum Demand (NMD rules) and changes to the connection charges. The tariff structure that was selected and was presented to the NERSA for approval is illustrated in table 4-5 below.

Table 4-5: Illustration of the final proposed tariff structure

Proposed Traiff Structure

				Fixed charge	Energy charge			Capacity charge	
Category	Tariff Name	Meter Type	Tariff Scale	Service Chg (R/Cust/Mth)	Energy Chg (c/kWh)	2 period T.O.U Energy Chg	3 period T.O.U Energy Chg	Demand Chg (R/kVA/Mth)	Network Access Chg
Residential Low	Home Use		4		X				
Residential High	Res TOU		3	X			X		
Residential Low	Home P/P		9		X				
Residential Low	FBET		12		X				
Business Low	Commercial Low		1	X	X				
Business High	Scale 2		2	X		X			
Business High	Commercial Time of Use		2	X			X		
Business Low	Commercial P/P		10		X				
Industrial	LV3pt			X	X			X	
Industrial	New TOU			X			X	X	X

Key	Tariff state
	Unchanged
	Structural Change
	New
	Phased out

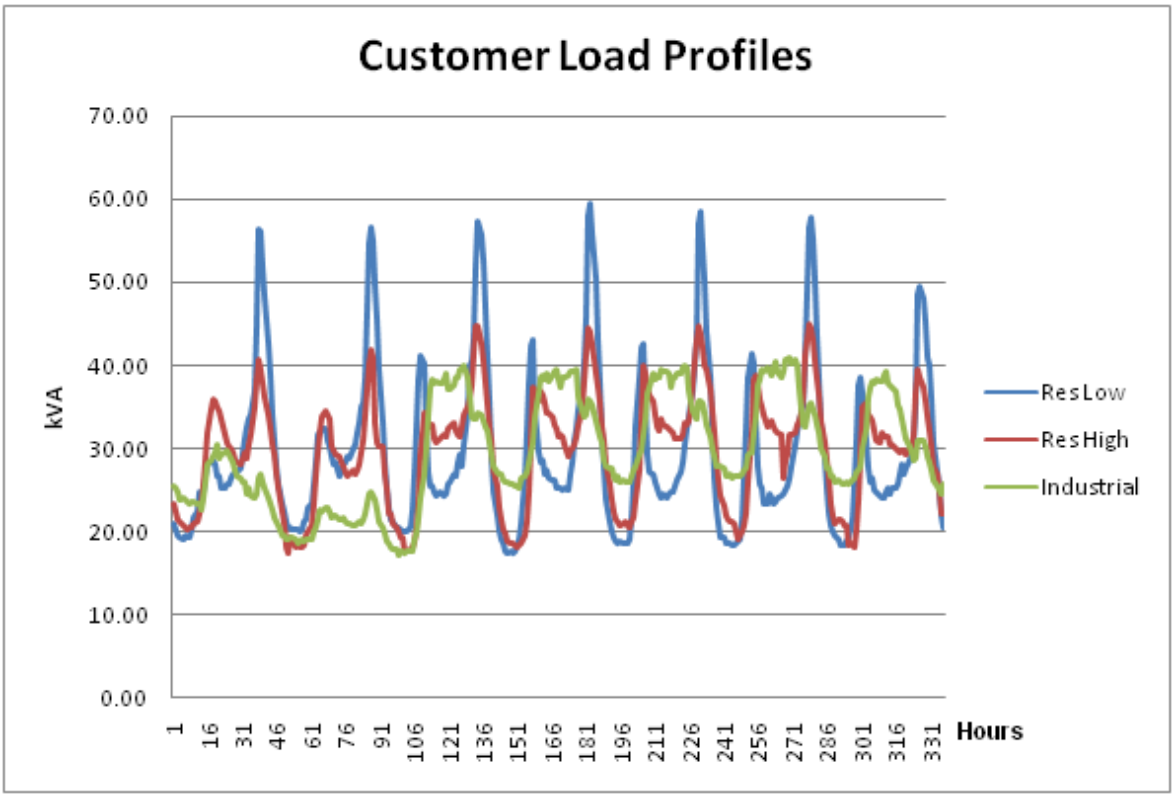
4.3 Load profile data

Annual load profile data was extracted from the SCADA system and was used to determine customer load profiles. This was done in consultation with the network control officers who assisted in identifying the different categories of customers that were fed off individual feeders from the major substations. The profile graph shown in figure 4-1 illustrates the comparison in profiles between some of the customer categories. In this example each of these categories had a total of 5000kWh which was used to compare profiles and calculate their load factors. Meter profile recorders were also installed for the business customers and the readings were used to work out the range of the load factors and create profiles for the business customers. Table 4-6 shows the load factors that were calculated in relation to these residential load profiles.

Table 4-6: Load factors for the residential consumers

Res- Low	Res - High	Industrial
50%	66%	72%

Figure 4-1 : Residential load profiles (SCADA load readings)

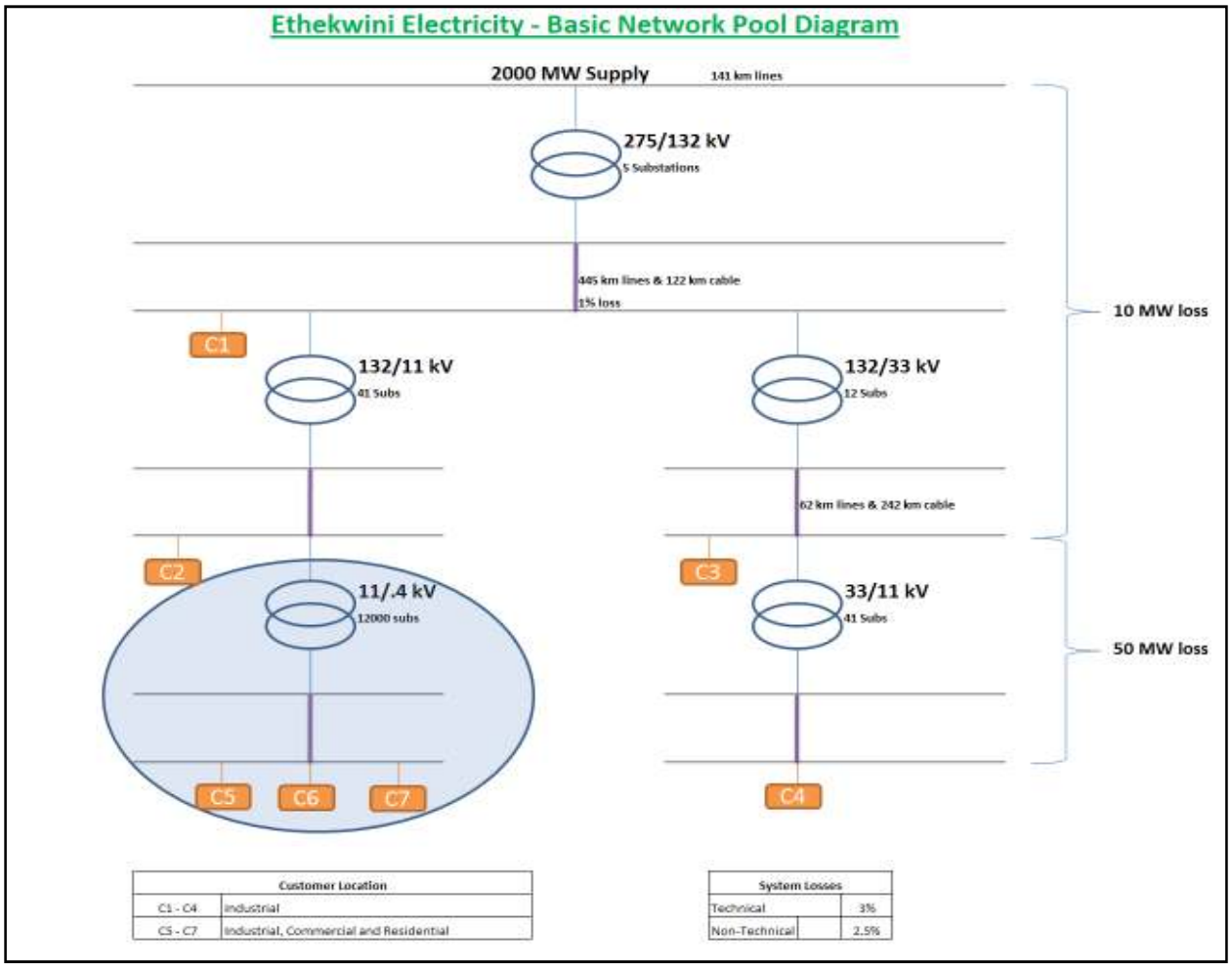


4.4 Cost of Supply study

A very basic cost of supply study was done in order to establish the costs associated with supplying customers in each category and the individual tariffs levied against them. This study was important especially when the new tariffs were being designed and the new components such as service charges were introduced. It also assisted with the application of cross subsidies. The customers were pooled together and arranged in seven different customer categories. The reason for keeping the categories separated even though they were located on the same points on the RND was to keep all costs separate without affecting the model. The asset register that was used captured all the assets that are owned by EE. The summated capital costs used were broken up between the

different infrastructure components such as lines, cables and substations for each of the different voltage levels. The initial and very basic reduced network diagram that was constructed is illustrated in figure 4-2.

Figure 4-2: Reduced network diagram



By using the financial statements provided, a 'cost of supply financial statement' was completed. The budgeted income included the energy sales and other charges whilst the expenditure comprised of the network costs, support costs, electricity purchases and the contributions to 'rates and general'. At that point, the budgeted and forecasted figures were used. The shared costs were further separated for the Administration and Finance Department and for the Human Resources Department. A percentage split was used for the determination of costs that were engineering and support related. The summary of the cost of supply financial statement that was used is shown in Table 4-7.

Table 4-7: COS Financial Statement

Income	2009/2010		
Sales - Energy	R	5,872,548,500	
Other charges - Incl grants	R	303,128,390	
Grants - Transferred to capital	R	144,261,780	
Total	R	6,319,938,670	
		6,175,676,890	R -144,261,780
Expenditure			
Network Cost			
HV Ops	R	96,862,350	
MV / LV	R	378,747,440	
Technical Services	R	110,790,070	
Shared Costs	R	605,053,868	
Total	R	1,191,453,728	
Support Cost			
Customer service	R	130,798,840	
Shared Costs	R	260,848,562	
Total	R	391,647,402	
Electricity Purchases			
Eskom (Energy)	R	3,614,703,820	
Genereation (Landfill) M	R	500,000	
Genereation (Landfill) L	R	500,000	
Genereation (Landfill) B	R	-	
Total	R	3,615,703,820	
Contributions			
R&G + Other	R	612,136,320	
Total	R	612,136,320	
Difference	R	-508,997,400	
Shared Costs			
Finance/Admin	R	829,974,670	
			% Split
Engineering	R	580,982,269	0.70
Support Costs	R	248,992,401	0.30
Human Resources	R	35,927,760	
			% Split
Engineering	R	24,071,599	0.67
Support Costs	R	11,856,161	0.33
Energy Related Costs	R	3,615,703,820	62%
Fixed Costs	R	2,195,237,450	38%

		Cust. Serv	Admin	HR	HV Ops	MV/LV Ops	Tech., Supp
	Income	R 3,536,180	R 319,556,340	R 58,534,790	R 17,957,320	R 29,127,910	R 15,758,810
	salaries and wages	R 72,084,270	R 101,090,720	R 21,719,510	R 63,371,510	R 309,077,830	R 94,640,570
	General expenses	R 58,714,570	R 728,883,950	R 14,208,250	R 33,490,840	R 69,669,610	R 16,149,500
	Repairs and maint	R 15,151,100	R 100,821,780	R 411,460	R 80,570,970	R 297,362,120	R 21,472,770
less	recoveries	R 3,536,180	R 58,534,790	R 58,534,790	R 17,957,320	R 29,127,910	R 15,758,810
	Only Exp	R 145,949,940	R 930,796,450	R 36,339,220	R 177,433,320	R 676,109,560	R 132,262,840
NB:	*(contrib to rates are xcluded due to it not being a direct running cost)*						
	Grants						
	MIG (Cap)	R 5,041,000					
	Grant equity - share	R 44,876,160					
	Grant equity - elect	R 74,160,000					
	CONTRIBUTION RE - DEPRECIATION O		-25,333,040				

The 'COS-Revenue_Recovery' spreadsheet was populated with statistics such as the consumption, rand value and current rates for each of the tariffs. Fixed charges, energy charges and the demand charges were then derived by using results from this cost of supply spreadsheet seen in table 4-8.

Table 4-8: Derivation of charges from cost of supply results

						service charges				
Category	**Tariff Name**	**kWh**	**rands**	**rate**	**customers**	**support cost weight**	**Total Weight**	**cost per tariff using Support cost**	**Serv/Chg (2008/9) monthly**	**amount recovered from S/chg**
Residential Low	Res TOU	83,323,017	51,478,475	0.62	8,215	3	24,645	155	20	R 1,971,600.00
Residential High	Home Use	2,923,050,565	1,805,913,792	0.62	288,190	1	288,190	52	20	R 69,165,600.00
Residential Low	Small power users									
Residential Low	Home P/P	647,188,204	428,323,220	0.66	250,368	1	250,368	52		R 0.00
Residential Low	FBET	5,667,276	15,255,818	2.69	9,000	1	9,000	52		R 0.00
Business Low	Commercial Low	1,707,191,168	1,100,944,033	0.64	38,671	3	116,013	155	129.81	R 60,238,590.12
Business High	Commercial TOU	453,531,432	261,453,613	0.58	1,687	3	5,061	155	129.81	R 2,627,873.64
Commercial	Business Cooking									
Commercial	Water heating and pumping									
Commercial	Water heating and pumping									
Business Low	Commercial P/P	1,276,964	845,123	0.66	494	1	494	52		R 0.00
Commercial	Business and General						0	0		
Bulk	LV 2 part									
Industrial	Blk TOU	1,114,018,194	599,577,848	0.54	517	10	5,170	518	505.81	R 3,138,045.24
Bulk	ST 3 part						0	0		
Industrial	New TOU	3,991,585,053	1,584,243,670	0.40	213	20	4,260	1,036	1011.62	R 2,585,700.72
Streetlighting	Citylight	36,693,199	24,512,907	0.67	4		0	0		R 0.00
Column Totals		**10,963,525,072**	**5,872,548,500**	**0.5356**	**597,359**	**43**	**703,201**			**139,727,410**

Once the costs were derived, it was checked by multiplying the consumption by the tariff rates. In the case of the new time of use tariffs that did not have actual peak, standard and off-peak consumption values, the SCADA feeder load and some meter profile recordings were used to estimate these values. The results according to the model that was used for the split units and the rates are shown in table 4-9 below.

Table 4-9: Consumption split

		High Season			Low Season		
No of Cust	kWh	Peak kWh	Std kWh	O/Peak kWh	Peak kWh	Std kWh	O/Peak kWh
8,215	83,323,017	3,861,866	8,654,518	8,314,370	11,585,599	25,963,555	24,943,109
288,190	2,923,050,565						
250,368	647,188,204						
9,000	5,667,276						
38,671	1,707,191,168						
1,687	453,531,432	19,486,707	46,767,814	47,128,337	58,460,122	140,303,442	141,385,010
494	1,276,964						
517	1,114,018,194						
213	3,991,585,053	171,504,872	411,609,193	414,782,198	514,514,616	1,234,827,580	1,244,346,593
4	36,693,199						

Table 4-10: Tariff rates table

	Fixed charge	Energy charge							Capacity charge	
Category	Service Chg (R/Cust/Mth)	Energy Chg (c/kWh)	High / S T.O.U Peak Chg	High / S T.O.U Std Chg	High / S T.O.U Off/P Chg	Low / S T.O.U Peak Chg	Low / S T.O.U Std Chg	Low / S T.O.U Off/P Chg	Demand Chg (R/kVA/Mth)	Network Access Chg
Residential Low	50	0.5587	83.577	42.6	31.98	83.58	42.6	31.98		
Residential High	20	0.5942								
Residential Low										
Residential Low		0.6618								
Residential Low		0.6618								
Business Low	129.81	0.6096								
Business High	103.85		124.51	49.1	36.73	51.04	40	34.76		
Commercial										
Commercial										
Commercial										
Business Low		0.6618								
Commercial										
Bulk										
Industrial	505.81		x	x	x	x	x	x	x	
Bulk										
Industrial	1011.62		85.45	24.76	14.82	27.29	18.09	13.71	36.78	11.39
Streetlighting		0.6681								

Table 4-11 : Separation of charges into tariff components

	Recovery	Service charge	Energy Chg						
	Total Rands	Service charge	Single rate Energy Chg	High / S T.O.U Peak Chg	High / S T.O.U Std Chg	High / S T.O.U Off/P Chg	Low / S T.O.U Peak Chg	Low / S T.O.U Std Chg	Low / S T.O.U Off/P Chg
Res TOU	R 51,478,475.32	R 4,929,000.00		R 3,227,650.39	R 3,684,652.17	R 2,659,012.45	R 9,682,951.18	R 11,053,956.51	R 7,977,037.34
Home Use	R 1,805,913,792.14	R 69,165,600.00	R 1,736,748,192.14						
Small power users									
Home P/P	R 428,323,219.64		R 428,323,219.64						
FBET	R 15,255,818.24		R 3,750,726.47						
Commercial Low	R 1,100,944,032.89	R 60,238,590.12	R 1,040,705,442.77						
Commercial TOU	R 261,453,613.37	R 2,102,339.40		R 24,262,369.64	R 22,948,262.30	R 17,309,687.09	R 29,835,658.70	R 56,125,051.63	R 49,147,423.04
Business Cooking									
Water heating and pumping									
Water heating and pumping									
Commercial P/P	R 845,122.66		R 845,122.66						
Business and General									
LV 2 part									
Blk	R 599,577,848.08	R 3,138,045.24							
ST 3 part									
New TOU	R 1,584,243,670.36	R 2,585,700.72		R 146,546,774.05	R 101,907,185.60	R 61,478,068.56	R 140,406,215.05	R 223,426,615.33	R 170,611,583.71
Citylight	R 24,512,907.29								
	5,872,548,500	142,159,275	3,210,372,704	174,036,794	128,540,100	81,446,768	179,924,825	290,605,623	227,736,044

The final check was done by summating the total recovery of the individual components from each tariff and subtracting it from the estimated recovery for that tariff. Table 4-10 shows this reconciliation and it also allowed for each tariff component to be checked.

4.5 Tariff restructure and design

There was a major structural change to the bulk TOU tariff which was the only 3 period time of use tariff that eThekwini Electricity had. There were two new time of use tariffs created which were for the residential and the commercial customers. Because there were now three time of use tariffs, it became necessary to name all of them. The names given to the tariffs were as follows:-

ITOU – Industrial Time of Use

CTOU – Commercial Time of Use

RTOU – Residential Time of Use

Eskom's Megaflex tariff was used to determine the energy split and the structural composition of the various time of use tariffs. The design of these tariffs took into account the levels of customers and their ability to understand them. A simple non-seasonal time of use structure was used for the RTOU tariff for residential customers, a seasonally differentiated time of use tariff was used for commercial customers and a complex seasonal time of use structure with network demand and supply voltage charges was used for the industrial customers. A spreadsheet was developed for each of these tariffs when they were designed. The design of these new tariffs is described and explained as follows:

4.5.1 RTOU tariff

The RTOU tariff was designed as part of this study to be used with the rollout of smart meters that was supposed to have been implemented by July 2009. Due to this being a new technology and the huge capital expenditure outlay that was required, a safe and cautious approach was decided upon and this project is taking much longer than anticipated. The spreadsheet named "Residential-RTOU-Design_&_Risk-Analysis-Final" contained the design of the RTOU tariff. This tariff consisted of a basic service charge and a fixed energy charge.

The service charges were determined using the support service costs and the weighting of these services This was initially proposed for all residential customers. The intention was to reflect the

support costs as fixed components. However, it was decided at the executive committee meeting that the service charge for the flat rate residential tariff was not to be implemented at that time. The reason for this decision was to ensure that the low consumption customers did not pay a higher energy rate overall since the inherent support costs was in proportion to the customer's consumption at present. This demonstrated that the tariff design was not purely scientific by supporting cost reflectivity and that social factors such as the effect of tariff changes to the poorer customers were of importance as well.

Using the load profile data, profiles were derived for residential low, residential high and a residential mix category of customers. The electricity during each of the periods was determined and is shown in table 4-11. The three cases that were used consisted of 500kWh, 1000kWh and 2000kWh consumption per month. The results obtained on table 4-12 showed that the breakeven point for the RTOU and the existing flat rate tariff was 1000kWh. The intention was to design a residential tariff for customers that consume in excess of 1000kWh per month. It had to also be benificial for them to move across onto it.

Table 4-12: Consumption split between the TOU periods

High-Season	Peak	Standard	Off-Peak
Res-Low	18%	37%	45%
Res-Mix	18%	41%	41%
Res-High	19%	42%	40%

Table 4-13: Comparison between the Single Rate and TOU Tariffs

			Single Rate Tariff		TOU Tariff with Service Chg	
	Name	**Consumption**	**Total**	**Rate**	**Total**	**Rate**
Case 1	Res Low	500	**R 3,057**	0.5095	**R 3,376**	0.5626
	Res Mix	500	**R 3,057**	0.5095	**R 3,388**	0.5647
	Res High	500	**R 3,057**	0.5095	**R 3,417**	0.5695
Case 2	Res Low	1000	**R 6,114**	0.5095	**R 6,091**	0.5076
	Res Mix	1000	**R 6,114**	0.5095	**R 6,116**	0.5097
	Res High	1000	**R 6,114**	0.5095	**R 6,114**	0.5095
Case 3	Res Low	2000	**R 12,228**	0.5095	**R 11,522**	0.4801
	Res Mix	2000	**R 12,228**	0.5095	**R 11,572**	0.4822
	Res High	2000	**R 12,228**	0.5095	**R 11,688**	0.4870

There were various alternatives that were developed which ranged between a tradeoff between the fixed and variable components. The designs that had a larger variable component provided a stronger signal for load shifting whilst the higher fixed component provided a more subtle change from the current residential tariff. This will attract more customers by reducing the risk when they migrate onto it. Table 4-13 and table 4-14 show the difference in rates when using a 75:25 and a 50:50 ratio for the variable vs fixed costs.

Table 4-14: 75:25 split for variable/fixed costs

Seasonal	peak	std	off
Rands	1,813	1,712	1,060
kWh	2,225	4,986	4,790
Rate	0.814995	0.343343	0.221395
25% fixed	0.1274	0.1274	0.1274
New rate	0.942365	0.470713	0.348765

Table 4-15: 50:50 energy split variable/fixed costs

Seasonal	peak	std	off
Rands	1,209	1,141	707
kWh	2,225	4,986	4,790
Rate	0.543331	0.228896	0.147597
50% fixed	0.2547	0.2547	0.2547
New rate	0.798071	0.483636	0.402337

The 50:50 energy split was the most cost reflective due to the purchased time of use energy charges being approximately 50% of the costs. This tariff was designed using the 2008/2009 data. The 2009/2010 increase was then applied to it and this proposed RTOU tariff was submitted to the NERSA for approval. The crossover point between the single rate energy tariff and the RTOU was calculated to be 1000kWh thus making the RTOU tariff more attractive from that point for the typical residential consumer. The NERSA approved RTOU tariff is shown in Table 4-15 below. A risk analysis was also done by calculating the revenue that would be received via the proposed tariff as compared to the existing single rate tariff.

Table 4-16: Final RTOU Tariff

Residential Time Of Use (RTOU)			
	Active energy charge [c/kWh]		
	[Jan - Dec]		
Tariff	**Peak**	**Standard**	**Off Peak**
Component	**VAT excl**	**VAT excl**	**VAT excl**
Energy Charge	**94.24**	**47.07**	**34.88**

		(R)
Tariff Component		**VAT excl**
Service Charge		**65.1**

4.5.2 CTOU tariff

The commercial time of use tariff was designed to replace eThekwini's 2-rate tariff business tariff that allowed consumers to purchase energy on two time periods. The spreadsheet 'Commercial-CTOU-Design_&_Risk-Analysis-Final' was used to develop this tariff. Metering profile data from high, medium and low consumption groups within the 2-rate customer base were used as samples. The range of tariffs that were considered were non-seasonal time of use energy rates, seasonal rates excluding a demand component and a seasonal time of use energy rate that included a demand component as a penalty. In addition a 50:50 and 25:75 fixed to variable costs split was looked at. The risk analysis was done by calculating the revenue that would be received from the 2-rate customers and it was compared to the revenue that would be received from the CTOU tariff once the customers migrated over. The second analysis that was done looked at the comparison of the billing of customers from the ITOU to the CTOU tariff. The calculated amount was R108,627 which amounted to 0.1% of the estimated revenue. In order to inhibit the migration of the few identified customers from the ITOU tariff to the CTOU tariff, a demand component equivalent to the ITOU demand rate was imposed if the demand exceeded 100kVA. This was done to maintain the customers within their designated tariff and consumption group. The NERSA approved CTOU tariff is shown in Table 4-16.

Table 4-17: Final CTOU tariff

Commercial Time Of Use (CTOU)

Only available to customers with NMD < 100kVA

	Active energy charge [c/kWh]					
	High demand season [Jun - Aug]			Low demand season [Sep - May]		
Tariff	Peak	Standard	Off Peak	Peak	Standard	Off Peak
Component	VAT excl	VAT excl	VAT excl	VAT excl	VAT excl	VAT excl
Energy Charge	159.37	62.81	47.01	65.33	51.20	44.49

		(R)
Tariff Component		VAT excl
Service Charge		161.3

4.5.3 ITOU tariff

The ITOU tariff was designed to emulate Eskom's Megaflex tariff however it could not completely be the same structure with a percentage increase on each component. This was because the input energy cost represented only around 60% of the total costs. Eskom's tariff catered for charges for generation, transmission and distribution whereas EE is a distributer only. Table 4-17 shows the time of use tariff that existed in 2008/2009 and the new Industrial Time of Use (ITOU) tariff that was designed and approved for 2009/2010.

Table 4-18: Bulk TOU structural change

Current Time Of Use (excl. vat)	
(H/S) peak (c/kWh)	78.25
(H/S) std (c/kWh)	22.55
(H/S) off peak (c/kWh)	13.07
(L/S) peak (c/kWh)	23.94
(L/S) std (c/kWh)	15.84
(L/S) off peak (c/kWh)	11.94
Maximum Demand Charge (R/kVA)	48.16
~~Transmission Surcharge~~	1%
~~Technical Loss~~	3%
Voltage Surcharge	Based on Voltage
Distribution Surcharge	Based on NMD

Proposed Industrial Time Of Use (excl. vat)	
(H/S) peak (c/kWh)	109.37
(H/S) std (c/kWh)	31.69
(H/S) off peak (c/kWh)	18.97
(L/S) peak (c/kWh)	34.93
(L/S) std (c/kWh)	23.16
(L/S) off peak (c/kWh)	17.55
Network Demand Charge (R/kVA)	48.36
Network Access Charge (R/kVA)	14.97
Voltage Surcharge	Based on Voltage
Service Charge (Rand)	1713.63

The energy charges were changed to reflect the ratios between the peak, standard and off-peak components to be equivalent to that of Megaflex. The technical losses on the system amount to about 3% which needed to be accommodated in the energy costs. Due to EE's main supply intake points being 275kV, there was no distribution network cost as this charge only applied to Eskom's 132kV customers and below. In order for our tariff to be cost reflective, the distribution network cost was not included as part of the input costs. The restructured Megaflex tariff that was proposed at that time is seen below in Table 4-18.

Table 4-19: Proposed Megaflex tariff for 2009/2010

Eskom's Proposed MegaFlex (H/S)			
Charge	Rate	Ratios	3% Losses
peak (c/kWh)	108.86	0.714	112.1258
std (c/kWh)	28.36	0.186	29.2108
off (c/kWh)	15.18	0.100	15.6354
NAC (c/kWh)	0		
Trns/net (R/kVA)	2.09		
NDC (R/kVA)	6.75		
R/Engy (c/kvarh)	2.85		
RRL (c/kWh)	1.28		
S/Chg (R/mth)	1334.61		

Eskom's Proposed MegaFlex (L/S)			
Charge	Rate	Ratios	3% Losses
peak (c/kWh)	18.12	0.490	18.6636
std (c/kWh)	11.11	0.300	11.4433
off (c/kWh)	7.78	0.210	8.0134
NAC (c/kWh)	0		
Trns/net (R/kVA)	2.09		
NDC (R/kVA)	6.75		
R/Engy (c/kvarh)	2.85		
RRL (c/kWh)	1.28		
S/Chg (R/mth)	1334.61		

The maximum demand charge was split up into a network demand charge (NDC) and a network access charge (NAC). The NDC is the charge for the actual demand which is measured over a 30 minute interval. The NAC is the charge based on the customer's maximum notified demand. The current rate was therefore split according to the NAC to NDC ratio as seen in table 4-19. This ratio was derived from the transmission NAC and the network demand charge that EE paid. At that time the maximum notified demand was determined by the customer and if the maximum demand increases to higher than the notified demand, then that maximum demand becomes the new notified demand for the following 12 months. The notified demand was only resettable if the highest maximum demand for the rolling 12 months was lower than the system notified demand. Due to Eskom's NMD rule changes, EE's NMD rules were to change to follow that of Eskom. The new rules will now include penalties that will be imposed for exceeding the NMD.

Table 4-20: Split between the NAC and NDC

NAC to NDC Ratio	24%	76%
New TOU charges	R11.3868	R36.7754

The transmission surcharge and the technical loss components were excluded from the new tariff since these costs were now included in the energy charges. It was necessary to accommodate the flat rate RRL (rate rebalancing levy) that Eskom imposed as a cross subsidy component. In order to eliminate an additional component to the new tariff and to reflect it as a variable input cost, this charge was included in the seasonal time of use energy charges.

The revenue from the new ITOU tariff was calculated using the existing TOU customers' monthly billing data. There was much iteration done by changing the ratios between the notified demand and the maximum demand. Since the ITOU tariff was determined for the 2008/2009 year, most of the data was available and only a few months needed to have been estimated. Table 4-20 below shows a summary of the calculated revenues for both the existing TOU and the ITOU tariff. The estimated months were calculated using the average of either the high season or the low season months.

Table 4-21: Simulated revenue from the TOU and ITOU tariffs

	Current TOU	Industrial TOU	Difference
Jul	R 140,668,172.84	R 140,621,543.86	R 46,628.98
Aug	R 138,351,480.09	R 138,082,128.89	R 269,351.20
Sep	R 92,011,725.91	R 91,999,583.83	R 12,142.09
Oct	R 93,993,881.04	R 93,997,382.99	-R 3,501.95
Nov	R 87,182,346.24	R 87,350,168.02	-R 167,821.78
Dec	R 89,319,380.71	R 89,192,193.15	R 127,187.56
Jan	R 95,368,664.45	R 95,287,974.95	R 80,689.49
Feb	R 94,194,357.13	R 94,170,200.02	R 24,157.11
Mar	R 92,011,725.91	R 91,999,583.83	R 12,142.09
Apr	R 92,011,725.91	R 91,999,583.83	R 12,142.09
May	R 92,011,725.91	R 91,999,583.83	R 12,142.09
Jun	R 139,509,826.46	R 139,351,836.38	R 157,990.09
	R 1,246,635,012.60	**R 1,246,051,763.56**	**R 583,249.04**

Estimate (Average of other months)

The ITOU tariff that was submitted to and approved by NERSA is shown in Table 4-21 below.

Table 4-22: Final ITOU tariff

Industrial Time Of Use (ITOU)						
	Active energy charge					
	High demand season [Jun - Aug]			Low demand season [Sep - May]		
Tariff Component	Peak	Standard	Off Peak	Peak	Standard	Off Peak
	VAT excl (c/kWh)	VAT excl (c/kWh)	VAT excl (c/kWh)	VAT excl (c/kWh)	VAT excl (c/kWh)	VAT excl (c/kWh)
Energy Charge	109.37	31.69	18.97	34.93	23.16	17.55

			(R)	
Tariff Component			VAT excl	VAT incl
Network Demand Charge (R/kVA)			41.8	47.65
Network Access Charge (R/kVA)			12.54	14.3
Voltage Surcharge	Voltage	% Surcharge		
	275kV	0		
	132kV	2.25		
	33kV	3		
	11kV	10.5		
	6.6kV	12.75		
	400V	22.5		
Service Charge (Rands/account)			1714	1954

4.5.4 LV3-Part tariff

The LV3-Part tariff consisted of a restricted demand component that offered customers a discount if their maximum demand did not fall within 16:30 and 20h00. This period was based on the period that our maximum demand previously occurred. The initiation of this component was based on the premise that if the customers kept their demands low during this period, the amount that we pay Eskom for our maximum demand would be lower and this allowed us to offer these customers a discount based on avoided costs. An investigation into the occurrence of the maximum demand over previous months revealed that EE's maximum demand occurred outside of this period for 6 out of the previous 12 months which is reflected in table 4-22. This meant that EE was allowing customers discounts for periods that were not co-incidental with their maximum demand. Due to these reasons, the restricted demand period was changed to be from 16h00 to 20h00.

Table 4-23: 275kV MD occurrences

	MD (kVA)	Day	Time
Jan 08	1,687,435	29	16:00
Feb 08	1,890,043	19	16:00
Mar 08	1,863,344	11	16:00
Apr 08	1,729,421	22	16.00
May 08	1,774,058	14	18.00
Jun 08	1,800,648	19	18.00
Jul 08	1,779,384	16	18.00
Aug 08	1,775,295	18	18:30
Sep 08	1,779,384	3	18:30
Oct 08	1,721,738	6	18:30
Nov 08	1,829,540	-	-
Dec 08	1,813,327	11	16:30
Jan 09	1,831,847	27	16.00
Feb 09	1,878,773	19	16.00

4.6. Risk mitigation

In order to determine the risks associated with migration of customers between the different tariffs, the billing data was used to determine what the customers bills would be on the available tariffs. This was done for each customer for the high and low season months. The average cents per unit cost for the tariffs using the billing data and the SCADA and metering load profiles were calculated which established that the ITOU tariff was the cheapest in terms of cents per kWh, followed by the CTOU and then the Scale 1 tariff. Such tariff simulations are seen in Table 4-23.

Table 4-24: Examples of tariff simulations

Name	Basic mth	Schg mth	Peak (kWh)	Std (kWh)	O/Pk (kWh)	MD (kVA)	Scale 2	Scale 1	TOU
Company A	151,200	107,100	25,986	62,367	62,847	288	81,335	79,130.19	63,504
Company B	207,600	85,200	35,679	85,630	86,290	395	82,198	108,608.27	87,192
Company C	119,000	62,200	20,452	49,085	49,463	227	53,521	62,300.51	49,980

Name	NMD	Volt	Peak	Standard	Off Peak	MD	New CTOU	New ITOU	Diff
Company	126126	330	8616930	23535750	32151210	114660	R 32,485,506.41	R 23,970,629.64	R 8,514,876.77
Company	41775.36	330	3877920	9510720	11787360	37977.6	R 12,845,454.12	R 9,053,036.79	R 3,792,417.33
Company	28512	1320	2208000	5376000	4800000	25920	R 6,429,748.32	R 5,080,075.55	R 1,349,672.77

The final check that was done used a basic spreadsheet which contained actual and estimated income for the current year and then used the increases to determine what the forecasted revenue will be. When the increases were inserted, the current year's revenue is increased by that percentage and the estimated growth to generate the revenue requirement for the review year. The total revenue requirement was thereafter summated and checked against the budgeted revenue to ensure that the increases were acceptable as shown in Table 4-24. The risks associated with the restructure and the decrease in sales volumes was accommodated for in this spreadsheet which balanced the estimated recovery via the tariffs and the budgeted revenue requirement.

Table 4-25: Tariff increase check using financial information

	08/09		Increase		09/10	
	Energy/Demand	S/C			Energy/Demand	S/C
TOU	1,288,689,262	0	28.40		1,671,223,783	
BULK	397,953,218		33.00		534,570,558	
B&G		0			0	
RES + Other	1,488,566,210	0	26.20		1,897,356,263	
PRE-PAY	330,391,340	0	26.20		421,123,410	
Ebsst	23,203,660	0	15.00		26,951,051	
Scale 001	854,660,620	0	28.00		1,104,905,250	
Scale 2	208,410,350	0	33.00		279,957,623	
					0	
					0	
	4,591,874,660				**5,936,087,936**	
				1.292737362		
Financial Requi	5,936,375,560					3,280,971,950
Difference	-287,624	-0.0048%				

CHAPTER 5 CONCLUSION

The methodology that was developed was used for the 2009/2010 tariff review for eThekwini Electricity. The tariff proposal and the supporting information was sent to the NERSA and was approved thereafter. This review saw major structural changes to the tariffs that existed and the introduction of new time of use tariffs for the residential and commercial customers. Tariffs that were no longer cost reflective were discontinued from being offered to customers and proceeded to being phased off. Those that were being phased off were now removed and remaining customers on these tariffs were moved across to the available tariffs. A summary of the review is presented in table 5-1 that follows.

Table 5-1: Summary of 2009/2010 tariff review

Category	Scale	Description and Motivation	% Increase
Residential High	3	**Residential, credit customers - 3 phase, energy charge** The customers that consume more than 1000kWh will be eligible to move over to the introductory residential time of use tariff.	26.2%
Residential Low/High	4	**Residential, credit customers - 1 phase, energy charge** The customers that consume more than 1000kWh will be eligible to move over to the introductory residential time of use tariff.	26.2%
Residential Low/High	8	**Residential, prepayment customers - 1 phase, energy charge** The increase will be the same as the credit meter residential tariffs.	26.2%
Residential Low	9	**Residential, prepayment customers - 1 phase, energy charge (Subsidised Connection)** The increase will be the same as the credit meter residential tariffs.	26.2%
Residential Low	12	**Free basic electricity tariff** The free basic electricity tariff (FBET) will have the same increase	15%

		as the other residential tariffs. The 65 free units will continue to be provided.	
Residential High	13 (NEW)	**Residential Time of Use - Peak, standard and off-peak energy rate.** With the installation of smart meters, it becomes possible to administer a residential time of use tariff. This tariff will have a peak, standard and off-peak energy rate and a service charge. Our primary intention is to get the high consumption residential customers (>1000kWh) over onto this tariff. This tariff is to be administered subject to a smart meter being installed.	
Business Low/High	1	**Business and General - Service charge and single energy rate.** The average increase will be applied.	28%
Business High	2	**Two Rate Tariff - Peak and Off-Peak energy rate and a service charge.** We are in the process of phasing out this tariff. Customers are encouraged to move onto the commercial time of use tariff. The increase is therefore higher than the average increase.	33%
Business	5	**Business Cooking Tariff. (Obsolete)** This tariff has been phased out over the past few years and is now redundant. Most of the customers have moved off this tariff. The remaining customers will be migrated over to the scale 1 tariff. There is no negative monetary impact to the affected customers.	N/A
Business	6	**Industrial Water Heating and Pumping Tariff - 3Hr. interruption. (Obsolete)** This tariff has been phased out over the past few years and is now redundant. Most of the customers have moved off this tariff. The remaining customers will be migrated over to the scale 1 tariff. There is no negative monetary impact to the affected customers.	N/A

Business	7	**Industrial Water Heating and Pumping Tariff - 6Hr. interruption. (Obsolete)** This tariff has been phased out over the past few years and is now redundant. Most of the customers have moved off this tariff. The remaining customers will be migrated over to the scale 1 tariff. There is no negative monetary impact to the affected customers.	N/A
Business Low	10	**Commercial Prepaid** The average increase will be applied.	28%
Business Low	11	**Commercial Prepaid** The average increase will be applied.	28%
Business High (NEW)	14	**Commercial Time of Use - Consumption < 100kVA** This new tariff is structured to have a service charge and 3 periods of energy charge that is seasonally differentiated. There will be a peak, standard and off-peak energy charge that will correspond to all our time of use tariffs and Eskom's Megaflex tariff.	
Industrial		**Low Voltage Two Part – Medium to Large Industrial (Obsolete)** The customers on this tariff have been consulted with and are being moved over to remaining available tariffs.	N/A
Industrial		**Low Voltage Three Part Medium to Large Industrial** This tariff will no longer be available from 01 July 2009. This tariff will now be phased out with a higher than average increase.	33%
Industrial		**Super Tension Three Part - Medium to Large Industrial** We have only one customer on this tariff. The remaining customer has been consulted with and is being moved over to an available tariff.	N/A

Industrial		**Large Industrial - Consumption that is > 100kVA** Due to the various structural changes to the Eskom Megaflex tariff over the previous years, this time of use tariff has moved away from cost reflectivity. This industrial time of use tariff structure has been changed to emulate the restructured Megaflex tariff on which EE will purchase electricity as of 1 July 2009.	28.4%

The methodology that was developed provides eThekwini with a model for future tariff reviews that are more cost reflective and serves as a procedure that is conducted in a chronological order. The tariff model was developed in a modular form thus making it easy to be built upon and used in the reviews that follow. This now allows eThekwini to design cost reflective tariffs more accurately, determine the estimated revenue and meet the budgeted income. The importance of this model became evident when a summary for the revenue recovery was done until the end of August 2009 which indicated a deviation of the actual income of 0.1% from the budgeted income. This model thus becomes an important tool in the mitigation of financial risk to the business. It is often said that tariff design is more of an art than a science; I believe that it is a fair mixture of both.

Electricity pricing in a deregulated market becomes more important as the true costs needs to be determined to prevent problems with revenue recovery in an increasingly competitive environment. Most utilities in South Africa base their tariffs on average cost pricing for SPUs and inflate their input tariffs to determine their LPU tariffs. The assumption that is taken when this is done is that the load profiles of customers would not change. Distortions are introduced when consumers either increase or reduce load or shift their load between the peak and off peak periods. For utilities such as eThekwini, tariffs need to reflect both the pricing signals of the input tariff and the distribution system charges. The restructured tariffs which resulted from this study allows for the recovery for the infrastructure, operations and maintenance and the pass through energy costs. This would allow EE to compete in a competitive market more effectively

If other utilities develop similar methodologies or are able to follow NRS058 as an industry standard, it will become much easier to do tariff alignment and tariff design in a newly formed RED. The individual and separated costs can very easily be summated and allocated in new cost buckets according to the methodology that would be followed or formulated by that RED.

CHAPTER 6 RECOMMENDATIONS

The modular design of the model that was developed allows for the design of new tariffs and for existing tariffs to be revised without changing the model or the methodology. Tariff structure changes are usually done for reasons such as financial, social and political changes as well as changes to the input tariffs. It is important for annual cost of supply and tariff studies to be done to ensure that the tariffs are still cost reflective and that the budgeted revenue can be appropriately recovered. The methodology that was developed addressed the recovery of revenue via the electricity tariffs. Other charges such as the connection charges allow for the recovery of the cost of the infrastructure used to connect customers to the network. Due to new systems and processes that are being implemented by EE, a more in-depth study of some aspects of this methodology can be done.

6.1 First Schedule to the bylaws

The first schedule to the electricity bylaws refers to the connection charges that are applicable for eThekwini Electricity customers. It is recommended that the 1st schedule to the bylaws be amended at the same time as the second schedule which is the electricity energy tariffs and must be effective from the 1st of July every year. These two schedules work hand in hand and changes in one sometimes affect the other. The charges for material and labour change annually and by doing both the schedules together will ensure that all charges and tariffs are current and allows for the cost reflective recovery of these costs. Equipment such as meters can either be recovered via the first schedule or the second schedule. It therefore becomes necessary for a methodology for the recovery of connection charges to be formalized and documented for EE. In order to tie up these two schedules to EE's electricity bylaws, a pricing policy need to identify and address where costs are recovered.

6.2 Categorisation of customers

The categorization of customers was done in this study based on EE's customer base and the tariffs that are now offered by EE. Since there were no clear national guidelines when this categorisation

of customers was done, it is recommended that the categorisation be reviewed once national guidelines are developed. There will most certainly be a need to first categorise customers if the South African electricity industry decides to form regional electricity distributors (REDS) in the future.

6.3 Cost of Supply study

For the purpose of completing this model and using it for the 2009/2010 review, a very basic cost of supply study was done using ring fenced costs. An in-depth cost of supply study needs to be done where all costs of assets on the asset register are separated and grouped enabling the allocation of costs to be done more thoroughly. An asset management program is currently being carried out and the results of that program will allow for the comprehensive cost of supply study to be accomplished.

REFERENCES

[1] Electricity tariff structure review: Alternative tariff structures, Consultation paper by the Commission for Energy Regulation, 1 July 2007, page 2

[2] An electricity price model with consideration to load and gas price effects, Journal of Zhejiang University Science, Volume 6, November 2003, page 666

[3] Short-term electricity prices forecasting in a competitive market: A neural network approach, Electric Power Systems Research, volume 77, 2007, page 1297

[4] Electricity Regulation Act, Government Gazette REPUBLIC OF SOUTH AFRICA, Vol. 493, Cape Town, 5 July 2006, No. 28992

[5] Cost of supply methodology for application in the electrical distribution industry, NRS 058, First Edition, 2000, page 4

[6] Cost of supply methodology for application in the electrical distribution industry, NRS 058, First Edition, 2000, page 8-9

[7] Cost of supply methodology for application in the electrical distribution industry, NRS 058, First Edition, 2000, page 35

[8] Regulatory framework for the electricity distribution industry of South Africa, Revision 3, July 2004

[9] Reform of the Electricity Distribution Industry (EDI) in South Africa, Blueprint Report compiled by the Department of Minerals and Energy, February 2001

[10] Distribution Tariff Code, Distribution Code Version 5.1, September 2007, page 3-4

[11] Distribution Tariff Code, Distribution Code Version 5.1, September 2007, page 6

[12] Energy price comparisons study, Japanese International Cooperation Agency Energy Workshop, Japan, July 2009

[13] The Electricity Amended Act 2007, The Gazette of India, New Delhi, 29 May 2007

[14] http://en.wikipedia.org/wiki/Electricity_sector_in_India, April 2010

[15] The Irish Times, 13 November 2008, page 1

[16] Project Performance Evaluation Report, Memorandum to El Arish Power Project, 11 August 2004, page 7

[17] WB calls Egypt Govt to raise electricity price, Egypt News, 22 October 2009

[18] Eskom Revenue Application Multi Year Pricing Determination , NERSA, 2007

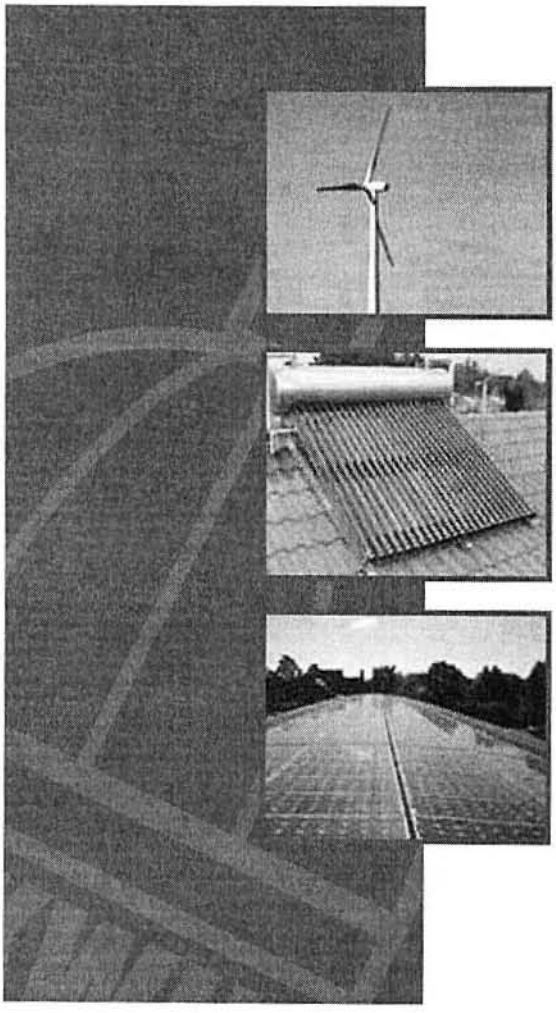
[19] ESKOM Annual Report, Eskom visual media, South Africa, 2009

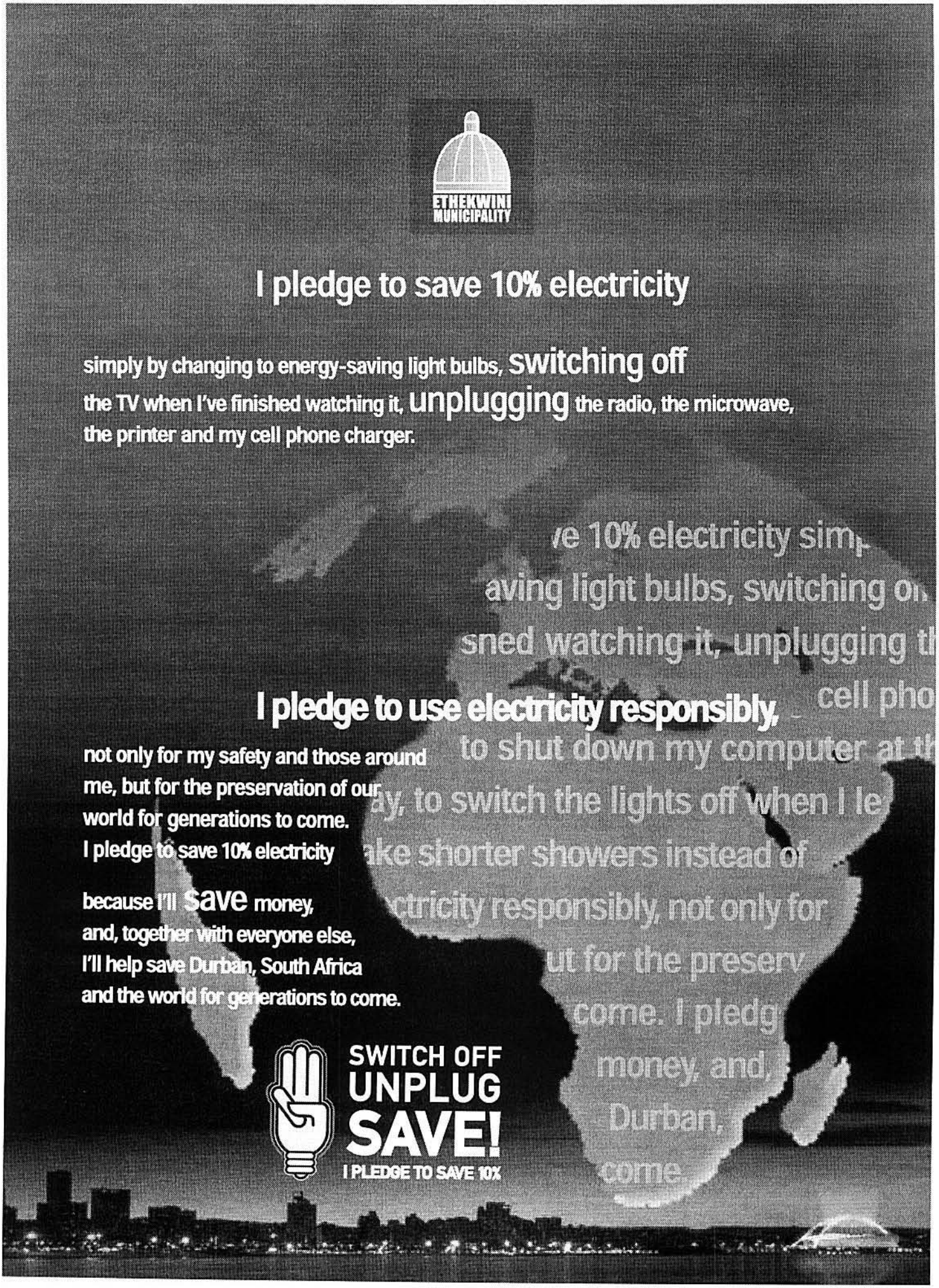
[20] Roula Inglesi, Aggregate electricity demand in South Africa: Conditional forecasts to 2030, Applied Energy, Volume 87, Issue 1, January 2010, Pages 197-204

[21] The pilot testing and findings of the Residential Time-of-Use Tariff (Homeflex) Project, V Singh and M Dekenah, Domestic use of energy conference, Cape Town, March 2008

Appendix A

ETHEKWINI ELECTRICITY
TARIFFS 2009/2010




ETHEKWINI MUNICIPALITY
I pledge to save 10% electricity
simply by changing to energy-saving light bulbs, switching off
the TV when I've finished watching it, unplugging the radio, the microwave,
the printer and my cell phone charger.
I pledge to use electricity responsibly,
not only for my safety and those around
me, but for the preservation of our
world for generations to come.
I pledge to save 10% electricity
because I'll save money,
and, together with everyone else,
I'll help save Durban, South Africa
and the world for generations to come.
SWITCH OFF
UNPLUG
SAVE!
I PLEDGE TO SAVE 10%

FOREWORD

The last year marked the beginning of an era of high electricity tariff increases in the country. The positioning of South Africa as one of the cheapest suppliers of electricity internationally is quickly diminishing. This can be attributed to the supply demand challenges and the need for Eskom to embark on a costly build program to address this challenge. Last year, Eskom was granted an average tariff increase of 27.5 percent, and this year a whopping 31.3 percent. The distributors that buy their energy from Eskom had to respond by hiking their tariffs accordingly, leaving the burden with the end customer. It must also be noted that the Eskom tariff increase includes a government levy of 2 cents per kilowatt hour on all electricity produced from non- renewable energy sources.

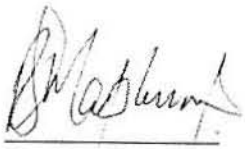
While the increase from Eskom to eThekwini Municipality was 31.3 percent, eThekwini only increased its tariff to its end customers by an average of 28 percent.

A review of our tariff structures also became necessary to ensure cost recovery is aligned to supply side tariffs. Obsolete tariffs are now excluded and the existing 3 Part Bulk and Scale 2 tariffs are no longer available to new customers. We have introduced two new Time-of-Use tariffs, one for the commercial and one for the residential sectors. The Industrial Time-of-Use (ITOU) tariff also encountered fairly substantial structural changes. It is through innovative crisis management methodologies and the slowdown in the economy, that the country has managed to avert the occurrence of widespread load-shedding, however, we continue to live under this threat. The challenge is to achieve reductions in electricity usage as the economy starts picking up again to maintain and grow the narrow safety margin we enjoyed since late last year. It is for this reason that I still urge our customers to use electricity efficiently and continue to contribute towards the attainment of a ten percent saving. Remember to Switch Off, Unplug, and Save.

There is little to cheer about with the burden of the rising costs weighing upon us. But, I am happy to announce that eThekwini still remains among the cheapest electricity supplying Metro's in the country and we will continually strive to keep the prices competitive.

Our employees have been and remain indispensable to our business. I would like to pay a special tribute to all of the employees of eThekwini Electricity for their loyalty, enthusiasm and commitment to their job at hand over the past and encourage them to continue in a similar fashion as we move into the future.

It is my sincere wish that Durban as a city will become an integral part of the solution to the challenges that we face, and will work hand in hand with eThekwini in resolving these challenges. Let us all conserve energy and protect our essential energy resources - the livelihood of our nation.



Sandile Maphumulo
Head: Electricity

ELECTRICITY TARIFFS AND SUPPLY CHARGES - 2009/2010

The contents of this brochure are intended merely as a guide and is subjected to change.
You are advised to request the latest official tariff schedules when necessary.

1. ELECTRICITY FAULTS NUMBERS

Contact Centre (All Regions) 0801 313 111

Streetlight Faults 0801 313 111

Cable Theft 031 311 9611

E-mail: custocare@elec.durban.gov.za

2. CUSTOMER SERVICE CENTRES

ETHEKWINI MUNICIPALITY SWITCHBOARD ..... 031 - 311 1111

CENTRAL REGION

Durban: Central Customer Services ..... 031 - 311 9063

The Rotunda, 1 Jelf Taylor Crescent

Pinetown: Pinetown Customer Services ..... 031 - 311 6295/6

Pinetown Civic Centre

NORTHERN REGION

Durban: HQ Building ..... 031 - 311 9068

1 Jelf Taylor Crescent

Besters: Bester's Customer Service ..... 031 - 311 6944

Corner MR93 / MR 452

SOUTHERN REGION

Isipingo: Isipingo Customer Services ..... 031 - 311 5623

1st Floor, 3 Police Station Road

Amanzimtoti: Amanzimtoti Depot ..... 031 - 311 5632

264 Old Main Road (old Drive - In site)

3. CUSTOMER SERVICE (BULK) ..... 031 - 311 9285/6/7

4. ACCOUNT QUERIES (BULK) ..... 031 - 311 1203

5. QUALITY OF SUPPLY ..... 031 - 311 9464

http://www.durban.gov.za

CONTENTS

SECTION A

RESIDENTIAL TARIFFS

BUSINESS TARIFFS

CONTENTS

LARGE POWER USER TARIFFS

SECTION B

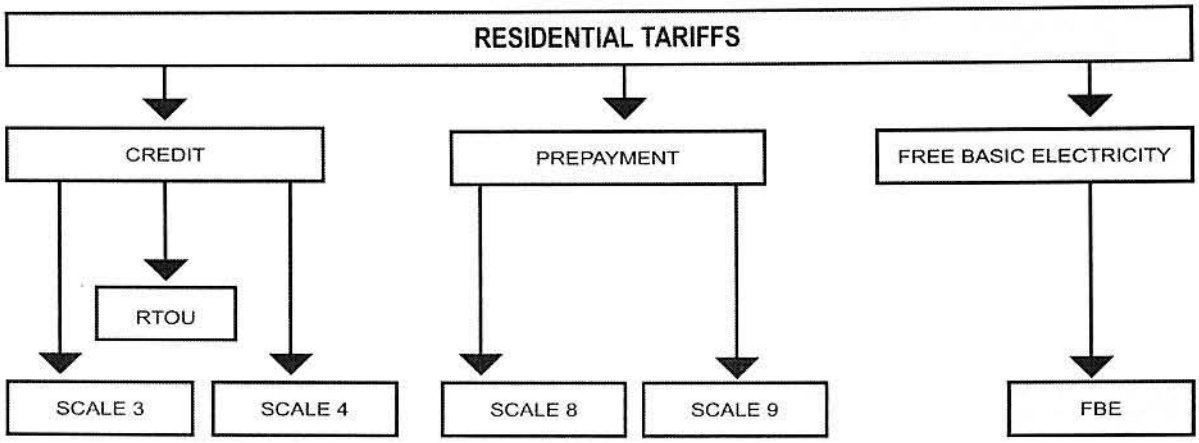
SECTION C

SECTION D

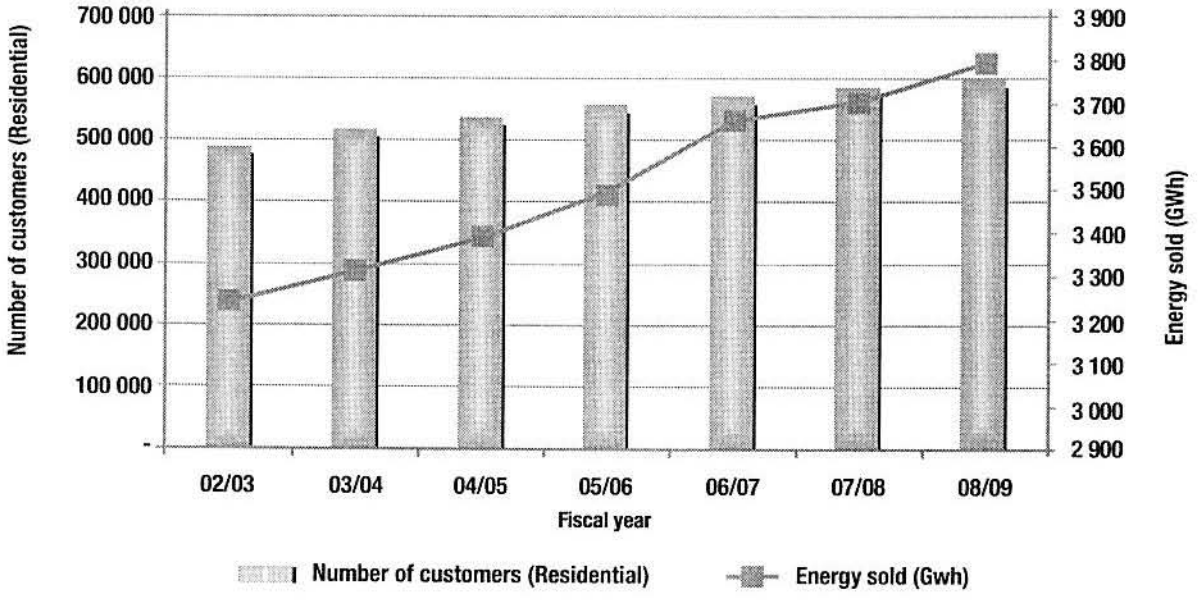
RESIDENTIAL TARIFFS

INTRODUCTION

These tariffs are only available to residential customers operating at either 230V (single phase) or 400V (three phase). Customers have the option of either purchasing electricity via a credit based tariff (i.e scale 3 & 4) or alternatively a prepayment based tariff (scale 8 & 9). Indigent residential customers who use below 150kWh per month quality for the FBE tariff. This tariff allows the customer to claim 65kWh of free electricity on a monthly basis.



STATISTICAL DATA: RESIDENTIAL TARIFFS



RESIDENTIAL TARIFFS

RESIDENTIAL CREDIT TARIFFS

SINGLE PHASE - SCALE 4

Typical Customers
Medium sized residential premises.
Supply size is 60A. (80A available in certain circumstances)

Service Charge
The service charge is built into the energy charge therefore a separate service charge is not applicable

Energy Costs

Energy Charge (c/kWh)	64.2964
VAT	9.0014
	73.2979

THREE PHASE - SCALE 3

Typical Customers

Large residential premises with ducted airconditioning, swimming pool etc.

Service Charge
The service charge is built into the energy charge therefore a separate service charge is not applicable

Energy Costs

Energy Charge (c/kWh)	64.2964
VAT	9.0014
	73.2979

Meters are typically read once in every three months. Estimated charges are raised based historical consumption.

RESIDENTIAL PREPAYMENT TARIFFS

SMALL POWER WITH ELECTRICITY DISPENSER - SCALE 8

Typical Customers
Small to medium sized residential premises.
Supply size is 60A, via a prepayment meter.

Service Charge
The service charge is built into the energy charge therefore a separate service charge is not applicable

Energy Costs

Energy Charge (c/kWh)	64.2964
VAT	9.0014
	73.2979

SMALL POWER WITH ELECTRICITY DISPENSER - SCALE 9

Typical Customers

Small sized residential premises.
Supply size is 40A, via a prepayment meter. This is a subsidised connection.

Service Charge
The service charge is built into the energy charge therefore a separate service charge is not applicable

Energy Costs

Energy Charge (c/kWh)	64.2964
VAT	9.0014
	73.2979

Prepayment customers pay for electricity in advance by using tokens or encoded numbers purchased from eThekwini Electricity Customer Service Centres or agents.

A deposit of R100 is required as an insurance against the cost of replacing the meter in the event of it being damaged. In the event of a meter being purposely damaged or bypassed, the required deposit is increased to R400.

RESIDENTIAL TARIFFS

FREE BASIC ELECTRICITY (FBE)

Typical Customers Small residential customers.
Supply size is limited to 40A single-phase..

Note: This tariff is only available to customers that consume less than 150kWh per month

Service Charge The service charge is built into the energy charge therefore a separate service charge is not applicable

Energy Costs

Energy Charge (c/kWh)	58.5902
VAT	8.2026
	66.7928

65kWh FREE per month

This tariff is currently available to customers that consume less than 150kWh per month. All customers on this tariff will be eligable to 65kWh of free electricity on a monthly basis. An online monitoring system is currently in place that identifies customers that qualify for FBE based on their last 11 months electricity usage. Customers that consume more than an average of 150kWh per month will not be eligable for FBE. FBE tokens must be collected on a monthly basis.

RESIDENTIAL TIME OF USE (RTOU)

This tariff allows residential customers, typically with a consumption greater than 1000 kWh per month to benefit from lower energy costs should they be able to shift their loads away from peak periods and towards standard/off-peak periods.

Prices exclude VAT

Residential Time Of Use (RTOU)	(Non Seasonal c/kWh)			Service Charge
	Peak	Std	Off-peak	(Rands)
	94.24	47.07	34.88	63.10

Energy Costs The energy cost is time differentiated into three distinct periods namely: Peak, Standard and Off-Peak

Service Charge This charge is fixed and is payable whether electricity is used or not.

Note: The implementation of this tariff is dependant on the availability of suitable technology.

Typical Costs Of Using Appliances

The following table shows the typical costs of running appliances on the residential tariffs.

Item	Electrical Rating In Watts	Hours Used Per Day	Days Used Per Month	kWhs Used Per Month	Monthly Cost At 73.2979 Cents/kWh Incl VAT
Air Conditioner	1 500	12	20	360	R263.87
Geyser	2 000	5	30	300	R219.89
Stove: Front Large Plate	1 500	2	30	90	R65.97
Stove: Back Large Plate	1 500	1.5	30	67.5	R49.48
Stove: Back Small Plate	1 000	1	25	25	R18.32
Stove: Front Small Plate	1 000	1	15	15	R10.99
Oven: Bake Element	1 500	0.5	20	15	R10.99
Oven: Grill Element	1 500	0.5	15	11.25	R8.25
Oven: Warmer Drawer	400	0.8	25	8	R5.86
Total Stove				231.75	R169.87
Hotplate: 2 Plate	1 500	3	30	135	R98.95
Heater: 2 Bar	1 000	5	15	75	R54.97
Pool Pump	750	8	30	180	R131.94
Dishwasher	2 500	2	25	125	R91.62
Refrigerator (With Freezer)	400	6.5	30	78	R57.17
Vacuum Cleaner	1 400	3	4	16.8	R12.31
Toaster	800	0.5	15	6	R4.40
Freezer (Chest)	250	6.5	30	48.75	R35.73
Microwave Oven	1 000	1	20	20	R14.66
Kettle	2 000	0.5	30	30	R21.99
Computer	480	2	15	14.4	R10.55
Clothes Iron	1 500	4	6	36	R26.39
Washing Machine	2 300	4	6	55.2	R40.46
Lighting: Single 100W	100	5	30	15	R10.99
Cellphone Charger	28	5	7	0.98	R0.72
M-Net Decoder / DVD Player	25	6	30	4.5	R3.30
Television: 51cm Colour	80	6	30	14.5	R10.55

Total cost = Kilowatts (Rating) x Hours of use x Per unit charge

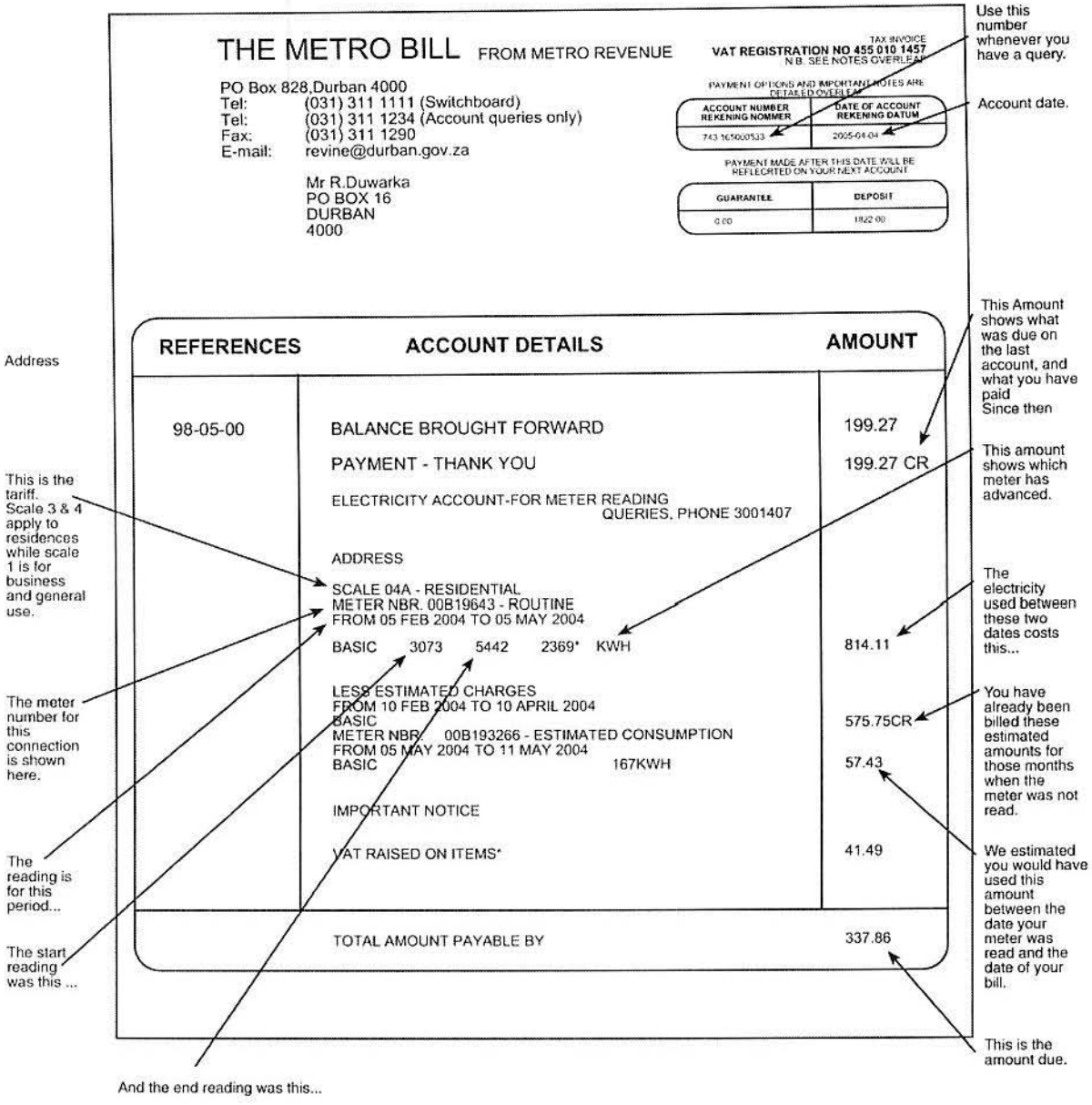
eg. large stove plates rated at 1500 Watts is used for 2hrs per day for 30 days.
- Convert watts to kilowatts : Divide by 1000
- Convert cents to Rands: Divide by 100

$\frac{1500}{1000}$ kW x 2hrs x 30 days x R $\frac{73.2979}{100}$

1.5 x 2 x 30 x 0.732979

R65.97

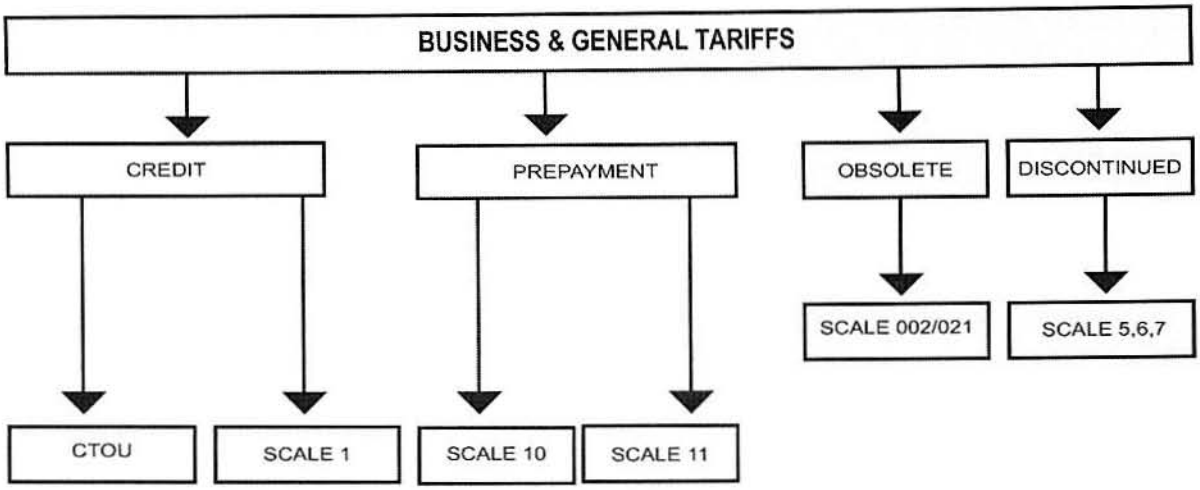
(SAMPLE)


THE METRO BILL FROM METRO REVENUE
TAX INVOICE
VAT REGISTRATION NO 455 010 1457
N.B. SEE NOTES OVERLEAF
PO Box 828,Durban 4000
Tel: (031) 311 1111 (Switchboard)
Tel: (031) 311 1234 (Account queries only)
Fax: (031) 311 1290
E-mail: revine@durban.gov.za
Mr R.Duwarka
PO BOX 16
DURBAN
4000
PAYMENT OPTIONS AND IMPORTANT NOTES ARE DETAILED OVERLEAF
ACCOUNT NUMBER REKENING NOMMER
DATE OF ACCOUNT REKENING DATUM
743 165000533
2005-04-04
PAYMENT MADE AFTER THIS DATE WILL BE REFLECTED ON YOUR NEXT ACCOUNT
GUARANTEE
DEPOSIT
0.00
1822.00
REFERENCES
ACCOUNT DETAILS
AMOUNT
98-05-00
BALANCE BROUGHT FORWARD
199.27
PAYMENT - THANK YOU
199.27 CR
ELECTRICITY ACCOUNT-FOR METER READING QUERIES, PHONE 3001407
ADDRESS
SCALE 04A - RESIDENTIAL
METER NBR. 00B19643 - ROUTINE
FROM 05 FEB 2004 TO 05 MAY 2004
BASIC 3073 5442 2369* KWH
814.11
LESS ESTIMATED CHARGES
FROM 10 FEB 2004 TO 10 APRIL 2004
BASIC
575.75CR
METER NBR 00B193266 - ESTIMATED CONSUMPTION
FROM 05 MAY 2004 TO 11 MAY 2004
BASIC 167KWH
57.43
IMPORTANT NOTICE
VAT RAISED ON ITEMS*
41.49
TOTAL AMOUNT PAYABLE BY
337.86
Use this number whenever you have a query.
Account date.
This Amount shows what was due on the last account, and what you have paid Since then
This amount shows which meter has advanced.
The electricity used between these two dates costs this...
You have already been billed these estimated amounts for those months when the meter was not read.
We estimated you would have used this amount between the date your meter was read and the date of your bill.
This is the amount due.
Address
This is the tariff. Scale 3 & 4 apply to residences while scale 1 is for business and general use.
The meter number for this connection is shown here.
The reading is for this period...
The start reading was this ...
And the end reading was this...

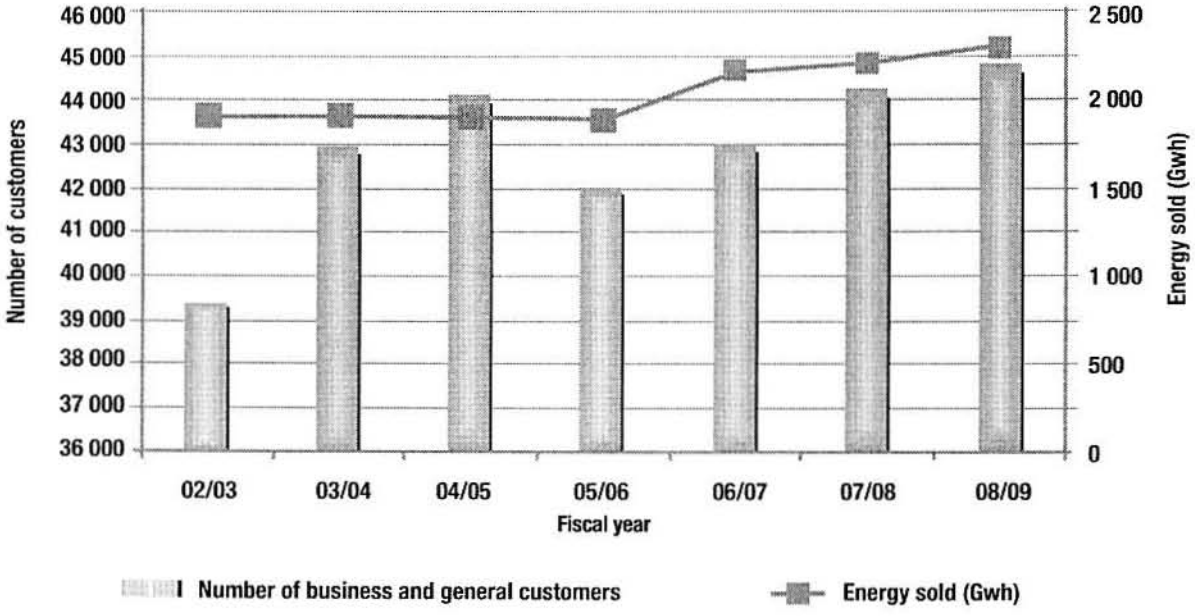
BUSINESS TARIFFS

INTRODUCTION

These tariffs are applicable to business and commercial customers consuming electricity at voltages not exceeding 11kV. Business and commercial customers have the option of purchasing electricity via a credit based tariff (Scale 1) or alternatively a prepayment based tariff (Scale 10 & 11).



STATISTICAL DATA: BUSINESS AND GENERAL TARIFFS



BUSINESS TARIFFS

COMMERCIAL TIME OF USE (CTOU)

This tariff is designed for customers with a Notified Maximum Demand of 100 kVA and below.

Prices exclude VAT

Commercial Time Of Use (CTOU)	High Season (c/kWh)			Service Charge
	Peak	Std	Off-peak	(Rands)
	159.37	62.81	47.01	161.30
For customers with Notified Max Demand less than 100kVA only	Low Season (c/kWh)			Service Charge
	Peak	Std	Off-peak	(Rands)
	65.33	51.20	44.49	161.30

Enegy Charge The energy charge varies according to the time and season of use.

Service Charge The service charge is fixed and is payable whether electricity is used or not.

This tariff is strictly for customers with an Notified Maximum Demand of 100kVA and below. In instances where the demand exceeds 100kVA, the customer shall be charged for the exceedance as follows:

Maximum Demand Change R(kVA)	54.34	7.61	61.95

BUSINESS & GENERAL CREDIT TARIFFS SCALE 1

Typical Customers Commercial and Industrial Customers.

Service Charge This is a fixed charge levied for each point of supply whether electricity is used or not.

Service Charge

Service Charge (R)	116.3092
VAT	16.2833
	132.5925

Energy Costs

Energy Charge (c/kWh)	66.9006
VAT	9.366
	76.2667

Concession No service charge is applicable for religious buildings

Voltage Rebate A 2% rebate is applied to the energy charge for supply voltages exceeding 1000V.

General Meters are typically read every three months.

Estimated charges are raised in months where no meter readings are taken and these are reversed when actual consumption is charged for. A deposit to cover up to three months consumption is required. This is periodically reviewed and increased deposits may be charged where required.

BUSINESS & GENERAL PREPAYMENT TARIFFS

B & G PREPAYMENT - SCALE 10

Typical Customers
Small commercial customers who use electricity mainly during the day or intermittently. Supply size is 60A, via a prepayment meter.

Service Charge
The service charge is built into the energy charge therefore a separate service charge is not applicable

Energy Costs

Energy Charge (c/kWh)	74.2692
VAT	10.3977
	84.6669

B & G PREPAYMENT - SCALE 11

Typical Customers
Small commercial customers who use electricity mainly during the day or intermittently. Supply size is 40A, via a prepayment meter. This is a subsidised connection.

Service Charge
The service charge is built into the energy charge therefore a separate service charge is not applicable

Energy Costs

Energy Charge (c/kWh)	74.2692
VAT	10.3977
	84.6669

Prepayment customers pay for electricity in advance by using tokens or encoded numbers purchased from eThekwini electricity customer service centres or agents.

A deposit is required as an insurance against the cost of replacing the meter in the event of it being damaged. In the event of a meter being purposely damaged or bypassed the required deposit is increased.

OBSOLETE BUSINESS TARIFFS — SCALE 002/021

Obsolete Tariff This tariff is currently active, but no longer available to new customers.

This tariff has been superceded by the Commercial Time of Use (CTOU). Please refer to page 9.

Prices exclude VAT

Description	Tariff	Tariff Component	Amount	
Scale 2 Commercial and Industrial Customers who use a significant portion of their electricity during the night and on weekends.	Scale 2 Meter type 002	Energy Charge (Basic) Energy Charge (Surcharge) Service Charge	26.62 63.30 116.31	(c/kWh) (c/kWh) (R)
	Scale 2 Meter type 021	Energy Charge (Peak) Energy Charge (Off-Peak) Service Charge	89.92 26.62 116.31	(c/kWh) (c/kWh) (R)

Note: Obsolete tariffs attract higher than normal increases, customers are therefore encouraged to review their load profile and investigate the feasibility of migrating to alternate tariffs.

DISCONTINUED BUSINESS AND GENERAL TARIFFS

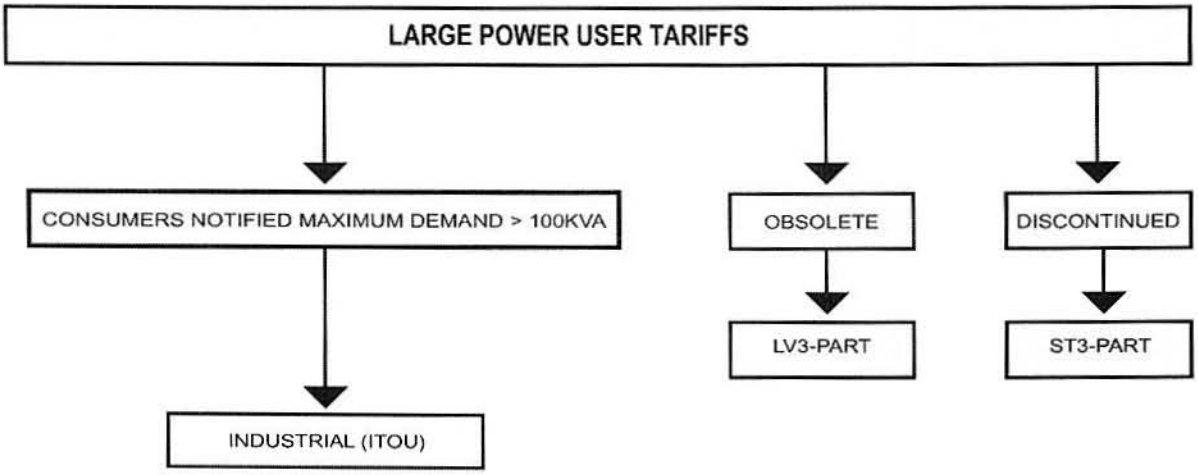
The following tariffs were deemed non cost reflective and have been discontinued:

Business Cooking	Scale 5
Industrial Water Heating and Pumping	Scale 6
Industrial Water Heating and Pumping	Scale 7

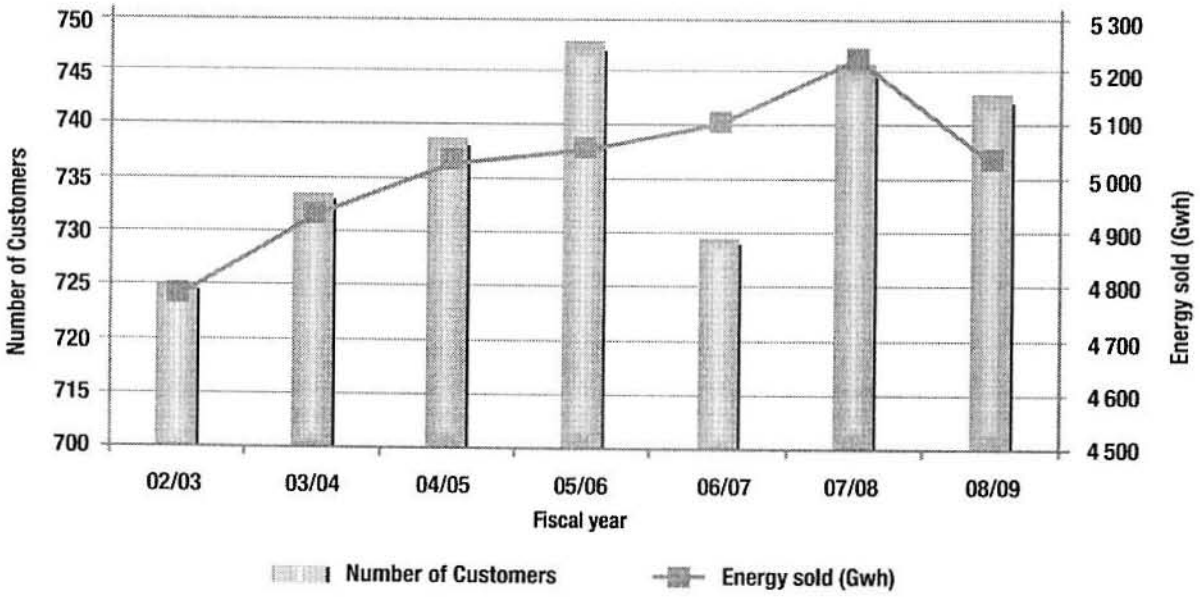
LARGE POWER USER TARIFFS

INTRODUCTION

The large power user agreements are entered into for a minimum period of one year. They are intended for customers that consume electricity on a continuous basis through out the year. The bulk tariffs are designed to have different rates for the same energy component during different time periods and seasons in order to comply with the cost of supply at different times more accurately.



STATISTICAL DATA: LARGE POWER USER TARIFFS



LARGE POWER USER TARIFFS

DEFINITIONS

DEFINATIONS FOR UNDERSTANDING BULK TARIFFS

Network Demand Charge (NDC) Is a charge that is variable on a monthly basis and is charged on the actual demand measured

Network Access Charge (NAC) Is a tariff component that is fixed on an annual basis and is charged as a R/kVA on the notified maximum demand

Restricted Demand The highest half-hourly demand in kVA taken by the customer between 16h00 and 20h00, Monday to Friday.

Energy Measured in kWh throughout the month.

Notified Maximum Demand The maximum demand notified in writing by the customer which the customer requires to be in a position to demand and remains in force for one year. The Notified Maximum Demand may be reduced by giving one month's notice, the revised Notified Maximum Demand shall remain in force for a further period of one year.

The Notified Maximum Demand is used for calculating the minimum charge which is based on 70% of the Notified Maximum Demand.

Notified Minimum Demand The minimum half-hourly demand notified in writing by the customer for the purpose of claiming a discount and accepted as the minimum value to be used for calculating the Maximum Demand Charge. The Notified Minimum Demand remains in force for one year and may be reduced by giving one month's notice, the revised Notified Minimum Demand shall remain in force for a further period of one year.

Service Charge Is a fixed charge payable per account to recover service related costs

PUBLIC HOLIDAYS

Date	Public Holiday	Actual Day of the week	TOU treated as
9 August 2009	National Women's Day	Sunday	Sunday
10 August 2009	Public Holiday	Monday	Saturday
24 September 2009	Heritage Day	Thursday	Saturday
16 December 2009	Day of Reconciliation	Wednesday	Saturday
25 December 2009	Christmas Day	Friday	Sunday
26 December 2009	Day of Goodwill	Saturday	Sunday
1 January 2010	New Year's Day	Friday	Sunday
21 March 2010	Human Rights Day	Sunday	Sunday
22 March 2010	Public Holiday	Monday	Saturday
2 April 2010	Good Friday	Friday	Sunday
5 April 2010	Family Day	Monday	Sunday
27 April 2010	Freedom Day	Tuesday	Saturday
1 May 2010	Workers Day	Saturday	Saturday
16 June 2010	Youth Day	Wednesday	Saturday

TIME OF USE TARIFF TERMS

High Demand Period — The period from 1 June to 31 August inclusive.

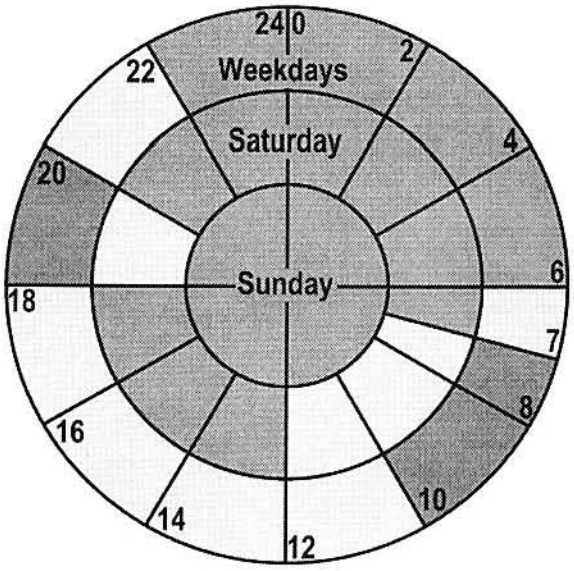
Low Demand Period — The period from 1 September to 31 May inclusive.

Peak, Standard and Off-Peak Periods — The different times during the day, as shown in the graph below, during which varying energy and demand charges apply.

Maximum Demand — The highest half-hourly demand in **kVA** taken by the customer during Peak and Standard periods in the month.

Energy — Measured in **kWh** during Peak, Standard and Off-Peak periods during the days of the month according to the graph below.

Time Intervals



Peak

Standard

Off-Peak

HIGH DEMAND (1 JUNE - 31 AUG) / LOW DEMAND (1 SEP - 31 MAY)			
TIME PERIODS	MON - FRI	SAT	SUN
22:00 - 06:00	OFF-PEAK	OFF-PEAK	OFF-PEAK
06:00 - 07:00	STANDARD	OFF-PEAK	OFF-PEAK
07:00 - 10:00	PEAK	STANDARD	OFF-PEAK
10:00 - 12:00	STANDARD	STANDARD	OFF-PEAK
12:00 - 18:00	STANDARD	OFF-PEAK	OFF-PEAK
18:00 - 20:00	PEAK	STANDARD	OFF-PEAK
20:00 - 22:00	STANDARD	OFF-PEAK	OFF-PEAK

LARGE POWER USER TARIFFS

INDUSTRIAL TIME OF USE (ITOU)

This tariff is designed for customers with an Notified Maximum Demand greater than 100KVA. Customers opting for this tariff will benefit if they can shift their energy loads away from peak periods and towards Standard/Off-Peak periods.

Prices exclude VAT

Industrial Time Of Use (ITOU)		Amount	
Peak	HIGH DEMAND SEASON JUNE - AUGUST	109.37	(c/kWh)
Standard		31.69	(c/kWh)
Off peak		18.97	(c/kWh)
Peak	LOW DEMAND SEASON SEPTEMBER - MAY	34.93	(c/kWh)
Standard		23.16	(c/kWh)
Off peak		17.55	(c/kWh)
Network Demand Charge (R/kVA)		41.80 (Based on Actual Demand)	
Network Access Charge (R/kVA)		12.54 (Based on Notified Max Demand)	
Service Charge		R1 713.63	
Voltage Surcharge		Voltage	%Surcharge
		275kV	0
		132kV	2.25
		33kV	3
		11kV	10.5
		6.6kV	12.75
		400V	22.5

Energy Charge The energy charge is time dependant as well as seasonally differentiated.

Network Demand Charge The network demand charge is based on the Actual Demand (kVA).

Network Access Charge The network access charge is based on the Notified Maximum Demand (NMD). Customers are encouraged to periodically revisit their NMD valves and set them accordingly to avoid unnecessary charges.

STRUCTURAL CHANGES

The ITOU (09/10) supercedes TOU (08/09). Please take note of the following structural changes:

TOU	SUPERCEDED BY	ITOU
Maximum Demand Charge		Network Access Charge
		Network Demand Charge

The following tariff components no longer apply:
- Transmission Surcharge
- Technical Losses
- Distribution Surcharge

OBSOLETE LARGE POWER USER TARIFFS — LV3-PART

Typical Customers

Commercial and Industrial Customers that are supplied at 400V or 11kV, using over 100kVA who are able to restrict their electricity consumption between 16h00 - 20h00.

Obselete Tariff

LV3-Part: This tariff is currently active, but no longer available to new customers.

Obsolete tariffs attract higher than normal increases, customers are therefore encouraged to review their load profile and investigate the feasibility of migrating to alternate tariffs.

Service Charge

Service Charge (R)	453.2168
VAT	63.4504
	516.6672

Energy Costs

Energy Charge (c/kWh)	26.5621
VAT	3.7186
	30.2808

Maximum DemandCharge

Maximum Demand Charge (R)	124.2442
VAT	17.3942
	141.6384

Restricted Demand Discount

Restricted Demand Discount (R)	26.800
VAT	3.752
	30.552

General

Minimum Charges

Minimum charges for agreements signed prior to 1 January 2000 are based upon 70% of the Maximum Notified Demand; the minimum charge for agreements signed after 1 January 2000 is based upon the greater of: 70% of Notified Maximum Demand, or 100kVA.

Restricted demand period: 16h00 - 20h00

DISCONTINUED BULK TARIFFS

The following tariffs were deemed non cost reflective and have been discontinued:

Supertension	(ST3-Part)
Excess night & weekend demand options	(ST3-Part)
Low Voltage Two-Part Tariff	(LV2-Part)

ADVISORY SERVICES

TARIFFS ANALYSIS

Customers are encouraged to study their load profile and ensure that they purchase electricity on the most efficient tariff structure available.

For more information and advice in this regard, please contact the Customer and Retail Services Department on:
031 311 9285/6/7

ENERGY EFFICIENCY ADVISORY SERVICE

EThekwini Electricity works closely with Eskom Energy Advisory services to provide advice on energy efficiency matters with the intention of helping customers to attain high levels of energy efficiencies within their factories.

For more information on this service, please contact the Customer and Retail Services Department on: **031 311 9285/6/7**

QUALITY OF SUPPLY SERVICES

EThekwini Electricity has adopted a quality charter recommended by the National Energy Regulator of South Africa (NERSA) which defines its commitment to ensuring the delivery of electricity of apropriate quality and of dealing with problems that customers may experience with regard to quality from time to time.

The Quality of Supply Branch of HV Network Control is responsible for conducting power quality investigations. These investigations are in accordance with the standards reflected in NRS 048 and concentrate primarily on Voltage Dips, Harmonics, Regulation, Unbalance and Frequency Flicker.

Please contact: **031 311 9464** for more information on services offers and applicable tariffs.

Voltage Dip are recorded and may be viewed on eThekwini Electricity's website: www.durban.gov.za/electricity.

GENERAL SERVICES

For general information and advice on all electrical related matters, please contact our Call Centre on: **080 1313 111**

Notice to our valued customers,

NERSA has approved an Eskom tariff structure change for municipalities effective 01 July 2009. Our bulk tariffs will need to be aligned to this structural change to promote the drive for cost reflectivity. This in turn will have a limited impact on customers. Customers will now have an opportunity to realize a reduction in their bill should they be able to shift consumption off the peak periods.

All the tariffs have been modeled to be revenue neutral for each agreement type. More information on these tariffs will be communicated at later stage once finalized and approved. In the interim, we would like to notify our bulk supply customers of the following changes that are proposed.

LV3-Part Bulk Agreements

The LV3-Part tariff will be discontinued from 1 July 2009. The restricted demand discount times will now be changed from 6:00 to 22:00 on weekdays. The LV3-Part tariff will attract a higher tariff increase in an effort to move existing customers off this tariff. Customers are encouraged to move onto the proposed time of use tariffs which will become cheaper.

Time of Use Agreement

The current Time of Use tariff will now be restructured and aligned with Eskom's Megaflex tariff as follows:-

Current Time Of Use	
(H/S) peak (c/kWh)	78.2461
(H/S) std (c/kWh)	22.5502
(H/S) off peak (c/kWh)	13.0726
(L/S) peak (c/kWh)	23.9434
(L/S) std (c/kWh)	15.842
(L/S) off peak (c/kWh)	11.9373
Maximum Demand Charge (R/kVA)	48.1622
Transmission Surcharge	1%
Technical Loss	3%
Voltage Surcharge	Based on Voltage
Distribution Surcharge	Based on Notified Demand

Current Tariff (2008/2009 rates)

New Time Of Use	
(H/S) peak	83.0395
(H/S) std	23.0152
(H/S) off peak	11.5717
(L/S) peak	25.1127
(L/S) std	15.7102
(L/S) off peak	10.7824
Rebalancing levy (c/kWh)	1.28
Network Demand Charge (R/kVA)	36.7755
Network Access Charge (R/kVA)	11.3868
Voltage Surcharge	Based on Voltage
Service Charge	R 1334.61

Proposed Tariff (In 2008/2009 rates)

Also note that the minimum demand charge based on 70% of the notified demand will fall away and a 'Network Access Charge' will be introduced. This charge will be based on a minimum demand of 100kVA.

Commercial Time of Use Tariff

Seasonal	High Season (c/kWh)			Low Season (c/kWh)		
	peak	std	off	peak	std	off
New Com TOU	124.5073	49.0685	36.7288	51.0359	40.0026	34.7614

This is a new tariff that has been designed for customers below 100kVA that want to go onto a time of use tariff. Customers on this tariff will have to enter into an annual agreement.

LV2-Part and ST3-Part

The LV2-Part tariff is no longer available and customers on this tariff will be given an option to move onto one of our more cost reflective tariffs. We will be assisting the affected customers in this process.

Two Rate (Scale 2)

The Scale 2 tariff will be discontinued from 1 July 2009. In an effort to move existing customers off this tariff, it will attract a higher tariff increase. Customers are encouraged to move onto the proposed time of use tariffs which will become cheaper.

Appendix C

Electricity Tariff increase and structural changes for 2009/2010

(Subject to NERSA approval)

TARIFF INCREASES

The individual increases are tabled below:-

Tariff	Description	% Increase
Scale 3	Residential, credit customers - 3 phase, energy charge.	27%
Scale 4	Residential, credit customers - 1 phase, energy charge.	27%
Scale 8	Residential, prepayment customers - 1 phase, energy charge.	27%
Scale 9	Residential, prepayment customers - 1 phase, energy charge. (Subsidised Connection)	27%
Scale 12	Free basic electricity tariff	27%
Scale 1	Business and General. Service charge and single energy rate.	30%
Scale 2	Two Rate Tariff. Peak and Off-Peak energy rate and a service charge.	35%
Scale 10	Commercial Prepaid	30%
Scale 11	Commercial Prepaid (Subsidised Connection)	30%
LV3-Part	Low Voltage Three Part Medium to Large Industrial	36.5%
ITOU	Industrial Time of Use. Peak and Off-Peak energy rate, service charge and demand charge.	31.5%

STRUCTURAL CHANGES

Industrial Time of Use

The current industrial time-of-use tariff will have a structural change which will make it more cost-reflective. The new structure and the rates that will be applicable from 1 July 2009 are tabled below:-

Industrial Time Of Use (excl. vat)	
(H/S) peak (c/kWh)	109.20
(H/S) std (c/kWh)	30.27
(H/S) off peak (c/kWh)	15.22
(L/S) peak (c/kWh)	33.02
(L/S) std (c/kWh)	20.66
(L/S) off peak (c/kWh)	14.18

Rebalancing levy (c/kWh	1.68
Network Demand Charge (R/kVA)	48.36
Network Access Charge (R/kVA)	14.97
Voltage Surcharge	Based on Voltage
Service Charge (Rand)	1755.00

Note:

1. H/S = High Season (High demand period from June to August)
2. L/S= Low Season (Low demand season from September to May)
3. The network access charge (NAC) will be based on the notified maximum demand (NMD) for the industrial time of use tariff. Customers are urged to check their NMD and ensure that it is correctly stated.

Scale 5, 6 & 7

Customers that are on Scale 5, Scale 6 and Scale 7 will be moved onto the Scale 1 tariff. There will be no negative impact on the customer as a result. Customers are requested to consolidate split distribution boards.

Scale 2/21

This tariff will not be available to new customers from 1 July 2009

LV2-Part & ST3-Part

LV2-Part and ST3-Part will be redundant. The remaining customers on these tariffs will have to opt for one of the available tariffs.

LV-3 Part

The LV-3 Part tariff will not be available to new customers from 1 July 2009. The restricted demand period applicable to the LV3-Part customers will now be from 16h00 to 20h00.

NEW TARIFFS

Residential Time of Use

A residential time of-use-tariff will be introduced and will be available subject to the rollout of a Smart Metering project by Council. The rates that will be applicable from 1 July 2009 for this non seasonal tariff is tabled below:-

	(Non Seasonal c/kWh)		Service Charge	
Residential Time Of Use (excl. vat)	peak	std	off-peak	(Rands)
	106.14	54.07	40.62	63.50

Commercial Time of Use

A commercial time-of use-tariff will also be introduced from 1 July 2009. Business customers that have the ability to shift their load should consider migrating onto this tariff. The rates effective from 1 July 2009 for this tariff are tabled below:-

Commercial Time Of Use (excl. vat)	High Season (c/kWh)	peak	161.86
		std	63.79
		off	47.75
	Low Season (c/kWh)	peak	66.35
		std	52.00
		off	45.19
		Service Charge (Rands)	116.31

Appendix D

AGENDA

PROGRAMME DIRECTOR PV ZONDI

REGISTRATION & TEA		10:00 - 10:20
WELCOME & INTRODUCTION	CLR. VISVIN REDDY	10:20 - 10:35
ADDRESS	KRISH KUMAR	10:35 - 10:50
ELECTRICITY TARIFFS	ASHWIN RAMBALLEE	10:50 - 11:20
PRICING TRENDS	LESHAN MOODLIAR	11:20 - 11:35
ECS	NKOSANA NTLEKENI	11:35 - 12:00
ENERGY INITIATIVES	NISHAN SOOKNUNDAN	12:00 - 12:20
DISCUSSIONS		12:20 - 12:50
VOTE OF THANKS	SEW HARILAL	12:50 - 13:00

ETHEKWINI MUNICIPALITY

TARIFF Presentation 2009